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VOLUME 5 JUNE 1953 NUMBER 2

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OXFORD
AT THE CLARENDON PRESS
1953

OXFORD ECONOMIC PAPERS

(NEW SERIES)

OXFORD ECONOMIC PAPERS, of which eight numbers appeared at irregular intervals between 1938 and 1947, became a periodical in 1949 and is now published three times a year. The pre-paid subscription price is 25*s*., post free, and the price of a single copy 12*s*. net. Orders may be placed with any bookseller or sent direct to the Publisher.

THE JOURNAL consists, in the main, of articles by Oxford authors, but the editors will also be glad to consider contributions from elsewhere. As in the past, articles of considerable length, which embody the results of substantial research, are included from time to time. The editors also publish occasional articles on Economic History, Public Administration, and Scientific Method, provided these articles are likely to be of general interest to economists. Contributors receive 50 free offprints.

PAPERS should be sent to the General Editor, c/o The Clarendon Press, Oxford. All correspondence other than that dealing with contributions should be addressed to the Publisher:

GEOFFREY CUMBERLEGE, OXFORD UNIVERSITY PRESS
AMEN HOUSE, LONDON, E.C. 4

AN INAUGURAL LECTURE[1]

By J. R. HICKS

I. INTRODUCTORY REMARKS. II. THE LONG-RUN DOLLAR PROBLEM

1. Introductory Remarks

SOME may reckon economics as a parvenu among studies; but the Drummond Chair of Political Economy, which I have the honour to occupy, is no parvenu among professorships. There are today more than eighty professors, of various subjects, in Oxford; in 1825, when Henry Drummond made his benefaction, there were scarcely more than a couple of dozen. Thus, even among Oxford professorships, the Drummond Chair can boast a respectable antiquity; its place in the general history of economic teaching is, however, still more remarkable. I should like to recall something of its story to you, before proceeding to my main subject; it will (I hope) be an inspiration to me, and it embodies a tradition of which all Oxford economists have a right to be proud.

David Ricardo had died, very suddenly, in September 1823. However we estimate the value of his achievement (I would myself rate it very high), it cannot be questioned that he had given a shape to economic theory, so that it had become something teachable, a possible academic discipline. It is evident that this was strongly felt by the active minds which gathered round him; whether or not they were so strongly influenced by him as to be reckoned his followers, their minds had developed under his stimulus, and they were possessed of principles which they were anxious to propagate. Already in 1824 they were founding a Ricardo Memorial Lecturership in London; it could not be attached to a university, since no University of London was yet in existence; there is, however, a thread[2] which connects it with the Chair of Political Economy at London's University College.

Henry Drummond may be regarded as one of the lesser lights of the same group. He had himself published a pamphlet on currency[3] and a

[1] Delivered at All Souls College, 8 May 1953.

[2] J. R. McCulloch, who was (inevitably!) appointed Ricardo Lecturer in 1824, became the first Professor of Political Economy at University College, London, in 1828.

[3] *Elementary Propositions illustrative of the Principles of Currency* (1819). Senior's own copy of the 1820 edition is in the library at All Souls. The third edition (1826), which is reprinted in Drummond's *Parliamentary Speeches, &c.* (1860), contains an interesting addendum on the crisis of 1825.

The Catholic Apostolic 'Cathedral' at Albury, Surrey, which Drummond left as his other memorial to posterity, has made more impression than these economic writings upon his biographer in the *D.N.B.* But Drummond was not the only banker who combined religiosity with intelligent views on banking. It is clear that he took his economics quite seriously.

summary of economic principles in forty numbered paragraphs. There are some points in these paragraphs to which the modern reader is particularly sensitive, and which might make us label him as a Malthusian rather than a Ricardian; but I doubt whether he was much aware of the difference. What is quite certain is that he was a Tory, not a Radical (Philosophical or otherwise); thus, as was to be expected, it was under Tory auspices that the new ideas penetrated the Tory citadel.

It is nevertheless remarkable that the capitulation came so soon. It was not until 1828 that Cambridge consented to confer the title of professor (without stipend) upon the obscure George Pryme;[1] but the Drummond Chair follows hard on the heels of the Ricardo lecturership. Drummond had been an undergraduate at Christ Church twenty years earlier, but had no later Oxford connexions. He must have had an ally within the walls. I suspect that it was Edward Copleston, Provost of Oriel, who had himself written an economic pamphlet[2] and who appears as the presiding genius of the Chair in its first years. Perhaps it was Copleston who devised the system of election by Convocation,[3] five-year tenure, and no re-election except after an interval, which gave a special character to the Chair in the first half-century of its history.

Copleston is undoubtedly linked to Whately, the second professor (who founded the Whately Chair in Dublin); and we know that Whately had been the tutor[4] of Senior, who preceded him in the Drummond Chair. It would not be surprising if the Chair was created, to some extent, 'for' Senior; indeed there was no one who could have given it a better start. Senior was already a leading member of the Political Economy Club in

[1] It was not until 1863 (when Pryme had reached the age of 82) that Cambridge voted a stipend for its professorship. The old man, with some dignity, immediately retired.

[2] *A Letter to the Rt. Hon. Robert Peel on the pernicious effects of a variable standard of value especially as it regards the Conditions of the Lower Orders* (1819). It is singular that even a Provost of Oriel should have had the assurance to select the motto with which he adorns the title-page of this production: 'Laissez nous faire'.

[3] Such as is still the rule for the Professorship of Poetry. Copleston had himself been Professor of Poetry some years previously.

[4] I am tempted to quote the following extract from Jane Whately's Life of her father (*Life of Archbishop Whately*, 1866, vol. i, p. 17):

> 'An old and valued friend of his, the late Mr. Hardcastle, requested him to undertake the tuition of a young man of great promise, who had come up to the University with every expectation of honours, but had failed to answer a question in his divinity examination in the very words of the Catechism. The examiner remarked, 'Why, sir, a child of ten years old could answer that!' 'So could I, sir,' replied the young student, 'when *I* was ten years old!' But the sharp repartee did not save him from being plucked. Both he and his family were naturally much mortified; but being of a nature not easily crushed, the disappointment, which might have been hurtful to many, acted as a stimulus on him; he resolved he would retrieve his injured reputation, and for this it was important to secure a first-rate private tutor. Through their common friend, Mr. Hardcastle, he was introduced to Mr. Whately, and shortly after wrote home to his father—"I have got Whately for my private tutor, and I will have the first-class next term." He succeeded, and this was the commencement of a friendship between Richard Whately and Nassau William Senior which lasted through their lives.'

London at the time of his election;[1] alone among the early professors he had lively connexions with the world of affairs. Nevertheless it was Oxford which brought out the best in Senior. One does not feel drawn to him in his practical capacity, as Poor Law reformer, or opponent of factory legislation; but his Oxford lectures[2] have a touch of greatness. What I find in them is a distinct step forward in the process of applying Ricardian logic to premisses which are wider than Ricardo's; which means that Senior, at Oxford, was beginning to do what Marshall did, and what we are all (according to our lights) endeavouring to do today.

Many years have to pass before we find another Drummond professor who is Senior's peer. Most of his immediate successors were just dons; and donnish economists were at a much greater disadvantage in the days of Victoria than they are now, when factual provender streams in upon them by every post. It is not surprising to find them seeking refuge in the haven of dons—turning aside from what was to them the remote and intangible present and devoting themselves to the exploration of the past.

I have known economists who wax eloquent about the misdeeds of the 'historical school'; but we should not be unfair. Though the men of this epoch turned their backs on economics, they created economic history; and it may well be that the absence of a firm historical foundation was one of the things which had prevented the brief Ricardian flowering from ripening to harvest. I am tempted to reckon Thorold Rogers,[3] the greatest

[1] That famous club had been founded in 1821; Senior became a member in 1823.

[2] Many of the lectures which were given by Senior during his two periods as Drummond Professor (1825–30 and 1847–52) were published at the time. Some others were incorporated in his *Political Economy* (1836); most of the remainder are still extant in manuscript. For a full bibliography see Marian Bowley, *Nassau Senior*, p. 340.

[3] Drummond Professor 1862–8; and again 1888–90. The interval was filled by Bonamy Price, in whose days the statutes were changed, so that he was able to keep Rogers out of the chair for all those weary years.

The following extract from the *Oxford Magazine* of 7 March 1888 was dug out of his files by the present editor and reprinted in March 1953. I reproduce it here with his permission:

'There is no lack of candidates for the Chair of Political Economy. The field, on the whole, is a good one, and there is plenty of variety. The merits of Mr. Thorold Rogers do not need our commendation; his historical work constitutes a most substantial claim in his favour. There is probably no other candidate who has made such positive contributions to the study. The deputy-professor, Mr. Phelps, has made the poor-law peculiarly his own, and his lectures have been a great success. Mr. Edgeworth has worked, we understand, at the mathematical side of economics. Mr. Leadam has studied its political aspects in a Lancashire constituency. Mr. William Sidgwick is known for his acuteness and strength in controversy; his memory is fresh in the minds of all who attend Convocation. Mr. Ashley and Mr. Price have both done good historical work, and will do more. The *History of the Woollen Industry* and *Industrial Peace* show that the younger Oxford school is alive. Of the Cambridge candidates, Mr. Cunningham is known as the writer of some interesting works on the historical side of economics. Mr. Macleod has, it seems, a European repute for his knowledge of the theory of banking. Amid all these claims (and there may be other candidates beside) it will be hard if the electors cannot make a good choice.'

Though at this date the Drummond Professor was no longer publicly elected, it would seem that the tradition of the open ballot still lingered.

of the Drummond historians, as a forebear of Professor Habakkuk's, not of mine; but I am very conscious of the importance of history to the economist, and of the danger to which he is still exposed (even, I regret to say, in Oxford) of living too much in the present, out of history, in the short period.

I pass to the later age, in which the old statutes have been repealed, so that the Drummond has become a 'permanent' appointment, like other professorships. That epoch begins in effect with the election, in 1891, of F. Y. Edgeworth. Edgeworth's time at Oxford corresponds very closely with that of Marshall at Cambridge; and if Oxford could lord it over Cambridge in the days of Senior and Pryme, in the days of Marshall and Edgeworth the tables were turned. Marshall was without doubt the 'prime orb' (as Edgeworth himself put it);[1] but there are three economists in the whole world who stand, in that generation, next after Marshall—they are Pareto, Wicksell, and Edgeworth. I never knew Edgeworth myself—I think I once set eyes on him in the High—but his personality stands out from his work, and we have Keynes's Essay.[2] Yet Keynes, I feel, does not do Edgeworth justice; he did not know how great Edgeworth's influence upon the economists of my generation was going to be. Perhaps I may put it this way: we go to Marshall for the answers, but for the questions—the questions which still have to be asked even after Marshall—we go to Edgeworth.

Professor Macgregor, who succeeded Edgeworth in 1921, is still with us[3]; and my immediate predecessor, Sir Hubert Henderson, left us only the other day. In their time economics has at last taken its place in the general body of undergraduate studies, not in the isolation which Marshall imposed upon it at Cambridge, but as part of a general education in the 'principles and structure of modern society'.[4] I am myself quite sure that it is impossible to be a good economist unless one is more than an economist; I therefore hold that the principle of a mixed school is profoundly right. Yet I cannot help thinking that if P.P.E. had been born 20 years earlier (as it ought to have been), it would have been more historical and less philosophical than it is; economics itself is inclined to have an abstract bias, and I am not sure that the additional bias caused by the conjunction with philosophy is altogether an advantage. But the great disappointment of P.P.E. has been its failure to catch fire at the boundary of economics and politics. We live in a world where political and economic issues are more and more intertwined; yet 30 years' cohabitation in the P.P.E. school has borne singularly little fruit. If it were not for one or two outstanding exceptions, one might almost say that the only people in Oxford

[1] *Papers relating to Political Economy*, vol. ii, p. 47.
[2] *Essays in Biography*.
[3] (He died on 8 May 1953.)
[4] *Examination Statutes*.

who know anything about economics *and* politics are the undergraduates! Instead of being a Union, P.P.E. is no more than a loose Confederation; it has failed to overcome, on the side of teaching, the fissiparous tendencies which seem to be inherent in the organization of research.

We shall have to take care to avoid over-specialization even within economics. Taking economics, economic history, and statistics all together, we now have five professors and four readers—each of them having his own satrapy within the wide empire over which former Drummond Professors roamed at pleasure. By ancient right, my own province remains in principle uncircumscribed; but by subtraction, I judge that it has in practice been reduced to the department of economic theory. That, indeed, conforms with my own preference; I shall be content to walk, to the best of my ability, in the footsteps of Senior and Edgeworth, whose preference lay the same way. But theory, if it is to be of any use, must be about something; I do not intend to be restrained from theorizing about any part of economics because the pitch is already taken. All of us, I hope, will pay scant regard to property rights and will poach freely.

The subject which I have chosen for this lecture (it is high time that I turned to it) is an arrant piece of poaching; but I am sure that I can count upon forgiveness from the Nuffield Reader in International Economics.[1] The field which I have allotted to myself in this share-out is as much his as mine; he and I will be the last to insist upon *meum* and *tuum*.

Here I conclude this curtain-raiser; and must now ask you to turn your attention to graver matters.

2. The long-run dollar problem

I have chosen to devote the remainder of this lecture to the discussion of a particular problem, instead of attempting a broad survey of the current state of economics; but I do not think that I need to apologize for the choice which I have made. The problem which I propose to examine is of the first importance to all of us; it is perhaps the fundamental economic problem confronting this country. There are some simple and significant things which can be said about it by a proper application of the best-established methods of economic theory. With so good an opportunity to hand of showing the potentiality of my subject, it has not seemed necessary to look farther.

The particular line of thought about the dollar problem which I shall be developing was suggested to me by a passage in the Stamp Memorial Lecture, given in London last November by Professor J. H. Williams of Harvard, under the title *Economic Stability in the Modern World*. What Professor Williams there did was to draw a striking picture of the rate at

[1] Mr. R. F. Harrod.

which productivity has been increasing in the United States—not merely during the last decade but during the whole of the present century; he then went on to offer as his main explanation of dollar shortage the disparity between the *rate* of economic advance which America has been able to achieve and that which has been achieved by most other countries. Professor Williams is distinguished among American economists for his imaginative understanding of the problems of countries outside America; I believe that his diagnosis is substantially correct. As he rightly observed, the problems raised by such a disparity were insufficiently examined by 'classical' or traditional economists; but it does not follow that these problems are incapable of being treated in the classical manner. I think I can show that the classical methods are very well suited to the study of these modern problems. I shall therefore begin by asking what is the correct theory of the effects on international trade of disparate changes in productivity; I shall then say something about the bearing of the results I get upon the practical case of British relations with the United States.

This disparity with which we are to be concerned is a long-run phenomenon; thus the theory we are looking for must be a long-run theory. Since the disparate increases in productivity are to be thought of as going on all the time, there can be no state of equilibrium; but since we are to be interested in the process as a whole, not in particular incidents of the process, we need pay no attention to effects that are bound to be episodic. In practice, when a country experiences adverse trading conditions, it begins by running a deficit on its balance of payments—a deficit which is covered by loss of reserves (whether held in gold or in some other form) or in some other temporary way. But the extent to which such temporary expedients can be used is always limited; they can therefore do no more than provide breathing-time, without affording any permanent means of adjustment to an enduring difficulty. We are here to be concerned with permanent adjustments; we may therefore look across all such temporary expedients, and make it a rule that the balance of payments of every country goes on being balanced—somehow. The only countries which can export gold, so long as this rule holds, are the gold-producers; import of gold can only take place to the extent of the gold-producers' exports. Balance of payments deficits and surpluses also (for one country's surplus spells another's deficit) are otherwise ruled out.

This assumption of continuous balance is undoubtedly the right approach to the problem before us; it is justified in itself, but it is at the same time an immense convenience. It enables us to cut straight through a vast tangle of complications, which in practice occupies the whole foreground, and may easily prevent us from seeing the real issues. And it is not the only simplification which we are at liberty to make. Since our

inquiry is concerned with the effect of productivity changes, we can also cut out the 'geometrical' complications which bothered the generation of Marshall and Edgeworth; we can go straight back to the basic simplicities of Ricardo and Senior.

The distinguishing assumption of the Ricardian theory was the hypothesis of *constant cost*—that all commodities (or at least all manufactured commodities) are produced at a cost per unit which is independent of the amount produced. Dubious as this assumption may be in many connexions, in this place it is a very harmless simplification. For what makes cost curves slope upwards or downwards is changes in productivity *induced* by changes in the scale of output; in this inquiry, where we are concerned with the *effects* of changes in productivity, we should give ourselves unnecessary trouble if we bothered to sort out the spontaneous and induced changes into separate boxes. The assumption of constant cost merely enables us to treat all changes in productivity as spontaneous—and in the present context that does no harm at all.

I therefore assert with some confidence the perfect applicability of Ricardian theory to the problem which I have undertaken to examine. We can, indeed, not merely make Ricardo's assumptions, we can also ask some of Ricardo's questions. In particular, we must still distinguish between the real (or barter) effects of productivity changes and the monetary effects by which they are in practice so greatly complicated.

What I mean by barter effects are those which persist whatever the course of money incomes—those which remain even if we suppose that money incomes in the various countries can be changed in whatever way is necessary to make adjustment as simple as possible. By monetary effects I mean those which arise out of difficulties in the adjustment of money incomes. Nineteenth-century economists studied these monetary effects in terms of a particular 'monetary mechanism'; we are nowadays obliged to take a different view. But the changed approach to monetary problems does not prevent the distinction between real and monetary effects from holding good; it is, indeed, of crucial importance. For monetary difficulties are in principle capable of being eased, if not wholly dissipated, by appropriate institutions. Thus if the difficulty which we find is purely monetary, it ought to be possible to find a means of doing something about it; but if the monetary problem hides a real problem, no monetary wizardry can conjure it away.

The decks are now cleared, and we can get to work. I shall begin by setting out my analysis in rather formal terms.

Let us consider two countries, A and B, which are trading together, and which are such that productivity in A is increasing more rapidly than productivity in B. It will, I think, make little difference to the essence of

the argument (and will certainly facilitate its exposition) if we neglect the expansion of productivity in *B*, and simply assume that productivity in *A* is increasing while that in *B* remains constant. We begin from a position in which the balance of payments between the two countries is in balance, as we are bound to do by our assumptions; but it does not matter how the balance has been brought about. It may be due to the classical forces which were thought to operate under free trade, or to changes in the volume of employment, or to import restrictions. On any of these suppositions the argument would be substantially unaffected.

I begin by laying down a proposition of central (though in relation to practical problems rather limited) significance. If productivity in *A* is increasing *uniformly*—at the same rate in all of *A*'s industries—the barter effects of the development are most unlikely to be harmful to *B*. The simplest way of proving this proposition is to see what would happen if money incomes in *B* remained unchanged, while money incomes in *A* rose to the full extent of the rise in productivity. Then the cheapening of *A*-products would be wiped out by the rise in *A*-incomes, so that the prices of *A*-products would be unchanged. The prices of *B*-products are of course unchanged, so that all prices are unchanged. Money income in *B* is unchanged, so that there is no reason why *B* should buy any more or less of *A*-exports than before. But *A*-income has risen, and this will affect *A*'s demand for *B*-exports. Though it is possible to construct weird cases in which the conclusion would not follow, we can surely be confident that in practice a rise in *A*-incomes, with all prices constant, would cause *A*'s demand for *B*-exports to *rise*. This means that if *A*-incomes rose to the full extent of the rise in *A*-productivity, the balance of payments would turn in *B*'s favour. If it is not to turn in *B*'s favour, but to remain in balance, the rise in *A*-incomes must accordingly be less than the rise in productivity. But if *A*-incomes rise by less than the rise in productivity, there will be some reduction (however small it may be) in the prices of *A*-exports. Money income in *B* can remain constant, and the prices of *B*-products can remain constant; nevertheless the balance of payments can remain balanced, while *B* gets her imports from *A* rather more cheaply than before. The real income of the *B*-population must be somewhat improved.

Thus, so far as barter effects are concerned, a *uniform* increase in productivity in *A* is almost certain to redound to *B*'s advantage. So far, the classical optimism is justified; some part of the improvement in *A* will slop over to *B*.

What, however, of the monetary effect? It is an essential element in the story we have been telling that *A*-incomes rise relatively to *B*-incomes. There is a fall in the prices of *A*-products relatively to *B*-products, so that the commodity terms of trade (what are ordinarily called the terms of

trade) move in *B*'s favour. But the factorial terms of trade (to use Professor Viner's convenient expression for the ratio of money incomes, which is the relative value of *A*'s factors of production and *B*'s factors of production) move in favour of *A*. Now a strong movement of the factorial terms in *A*'s favour—and it will be a strong movement, if the change in productivity is considerable—is only consistent with a steady level of money incomes in *B* if money incomes in *A* are rising rapidly.' So far we have simply assumed that *A*-incomes do rise sufficiently rapidly; but though it is possible that the requisite rise in *A*-incomes may come about from some extraneous cause, it is difficult to think of any automatic mechanism which will have the desired effect. The classical mechanism of gold flows has been discredited, not only by modern theory but directly by modern experience; yet even if one believed in that mechanism, it could only do the job which is here in question to quite a limited extent. Deflation in *B* would only be prevented if there was a sufficient output of new gold to support the requisite rise in *A*-incomes; otherwise, the 'inflation' in *A* would have to be matched by a deflation in *B*. Even on the basis of this now outmoded theory, it would be expected that money income in *B* would decline, unless indeed there were a sufficient output of newly mined gold to come to the rescue.

A more modern approach would, in substance, confirm the same conclusion, though the qualifications which it would introduce would be different. We should now expect that an employer would be constrained to raise the weekly wages of his employees to some extent when they (or he) achieved greater productivity; but the initial gain which accrues to the employer from the introduction of more productive methods would be wiped out if he could not expect to secure a substantial net reduction in money cost from the improvement. It is further to be expected that when costs are reduced, then (by one or other competitive or semi-competitive mechanism) prices will soon follow. In the course of this adjustment there will be effects on saving (which are fairly clear) and effects on investment (which are not). I shall not attempt to discuss these in detail, but shall merely conclude (as I think most economists would do) that while there may be some 'natural' increase in money incomes in *A*, in consequence of the rise in *A*-productivity, it is most unlikely (in the absence of extraneous factors) that this increase will be sufficient to prevent the appearance of a downward pressure upon the level of money incomes in *B*.

It has therefore to be expected, if the rate of increase in productivity in *A* is rapid (or rapid relatively to the increase in productivity in *B*), that there will be a deflationary effect on *B*, assuming that there is a stable rate of exchange between *A*'s and *B*'s currency, and that *B* takes no special measures to counteract the deflation. This is what has to be

expected if the level of money incomes in *A* moves in what we may call a 'natural' manner. It is of course perfectly possible that special causes, such as rearmament, or a flood of specially capital-using inventions, may cause money incomes in *A* to rise more rapidly than has been assumed. If so, the monetary pressure on *B* would be relieved. But no reason has been advanced which would justify us in regarding such relief as anything more than a temporary exception to a general rule.

It does nevertheless remain true, under the assumptions that we have been making, that the only reason why *B* gets into trouble is that *A*-incomes fail to rise with sufficient rapidity. There will, we may say, be some *appropriate* rate of rise in *A*-incomes (less, but perhaps not much less, than the rate of increase in productivity) which will keep trade between the two countries in balance, even though the level of *B*-incomes remains in money terms completely unchanged. If *A*-incomes do rise at this appropriate rate, there need be no deflation in *B*, while *B* is actually benefited by a certain change in the commodity terms of trade in its favour. It is only when *A*-incomes rise at less than the appropriate rate that *B* gets into difficulties.

Now, at this point, instead of tracing out consequences any farther, I want to ask you to stand back from the picture I have been drawing, and ask: Is it right? Does it in fact describe the kind of thing we have been experiencing? Surely the answer is that it does not.

I have nevertheless chosen to draw it out in some detail, both because it is a useful basis for further investigation and because it has so evidently been in the minds of many people who have given advice on economic policy during these last years. I think that this was especially the case just after the war. One remembers very well how we used to be told (even by Lord Keynes[1]) that inflation in America was a very good thing from the point of view of this country—that it would help to get us out of our difficulties. It might not last for ever, but it would be a help to us so long as it lasted. Now if America and Britain were the *A* and *B* of our example, and if our picture was drawn correctly, that would be true. All that would have been necessary would have been that we should have stopped our wages from rising, while American wages continued to rise; we should then have been freed from balance of payments troubles, while we could have continued to enjoy our own modest rate of real economic progress. All we should have needed to do would have been to control our own inflation; in the conditions supposed, that should not have been particularly difficult. That is the story we used to be told; but after the experiences we have had, it can hardly go on being told to us any longer.

[1] I refer to Keynes's posthumous article, 'The Balance of Payments of the United States', *Economic Journal*, 1946.

What is it that has gone wrong? Not, I think, that the whole theory is wrong—though that is a conclusion to which people are only too ready to jump when they find a discrepancy between theory and fact. All that has happened is that a little assumption has crept in—an assumption which (unlike most writers on the subject) I have made explicit. It is the assumption that productivity in A is increasing *uniformly* in all industries.

No one, of course, has ever supposed that productivity does ever increase at a uniform rate in all industries; what has been implied is that differences between industries in this respect do not matter. There are indeed some sorts of differences which would not much matter; if the non-uniformity was quite random, it would certainly make little difference to the preceding argument. But it makes a very great difference if the non-uniformity is biased, so that the improvement in productivity is concentrated upon industries that have a special relation to foreign trade. There are two sorts of bias which come into question here, of which one is much more relevant to present discontents than the other. But we need to consider both sorts in order to get a balanced picture.

Let us accordingly take as our next subject of study the case in which the improvement in productivity is concentrated upon the goods which A exports; or, as we shall find it convenient to say, when the improvement is export-biased. In order to simplify the argument, let us say that there is a uniform improvement in productivity in A's export industries, but no improvement at all elsewhere. This, we shall find, is a case which is extremely favourable for B. For suppose that incomes remain constant in both countries; the prices of B-exports will then remain constant (for there has been no change in productivity in B), while the prices of A-exports are reduced. There is not much reason why the quantity of B-exports to A (and therefore their value, since their prices are constant) should be much affected; the quantity of A-exports to B must increase, but since their prices are reduced, it is by no means certain that their total value will rise. With suitable (and quite possible) demand conditions in B, it is perfectly possible that trade will continue to balance at unchanged money incomes in both countries—that is to say, at unchanged factorial terms of trade. Thus in this case there may be no monetary difficulty; and even if there is some, it will be fairly small. The commodity terms of trade must, however, turn in favour of B, so that in this case there is bound to be a real gain to B, which is greater than the gain which occurs in the case of all-round uniformity.

This, you may say, is a sweet story; but it is matched by the ugliness of what happens in the corresponding case of an improvement that is 'import-biased'—one, that is, that is concentrated upon the A-industries which compete most closely with B-exports. In this case it is certain that

the factorial terms of trade must turn against *B* (so that there are the same monetary difficulties as in the case of uniformity); but *B* is now afflicted with a *real* (or barter) loss as well. We can show this in the same manner as before. If incomes in both countries remained constant, the prices of *A*-products which competed with *B*-exports would fall, so that *A*'s demand for *B*-exports would decline; and this would itself be enough to cause a deficit in *B*'s balance of payments, for there would be no reason why *B*'s demand for *A*-exports should be affected. Thus in order to maintain a trade balance there must be a rise in *A*-incomes relatively to *B*-incomes; the factorial terms of trade must turn adversely to *B*. Further, since there has been no improvement in productivity in *A*'s export industries, a rise in *A*-incomes implies a rise in the prices of *A*-exports, so that the commodity terms of trade must turn adversely to *B*. Whatever are the monetary arrangements, whatever the course of money incomes, an improvement in *A*-productivity that is *import-biased* must make *B* worse off.

A balanced view of the matter we are discussing would therefore distinguish three cases: (1) that in which the improvement is export-biased, which is the least likely to lead to monetary difficulties, the least favourable from the point of view of the improving country, and the most favourable for the foreigner; (2) that in which the improvement is more or less uniformly distributed, when there may well be monetary difficulties, but in which (if the monetary difficulties can be overcome) some part of the gain goes to the foreigner; (3) that in which the improvement is import-biased, when there are monetary difficulties as in the second case, and a real loss for the foreigner as well. This is a pure classification of cases; but it is a natural common-sense classification, with nothing academic or artificial about it. It is the kind of classification which one would expect to be able to use for the analysis of historical and contemporary experience.

It is, indeed, tempting to hazard the guess that it can be translated, rather directly, into terms of historical categories. Those periods of history which have seen a great growth of *trade* must nearly always have been periods in which productivity, in some sense, was increasing; it is much easier to see how improvements in productivity should lead to a growth of *trade* if the improvements that are taking place are export-biased. Export-biased improvements increase the advantages of foreign trade relatively to those of domestic production; the growth of trade is thereby directly stimulated. It is, indeed, possible to argue that any great growth of trade, which is not purely due to geographical exploration, must be due to export-biased improvements; for it should be noticed that improvements in transport and in the art of merchanting reckon as export-biased

on our classification. But it is, of course, not necessary that the rate of improvement should be very different in the various countries that are trading together—though it would be surprising if such disparities were not in practice a pretty general rule.

We should further expect to find that the improvements which *start* a process of development will be export-biased. This is little more than a deduction from the general principle of the division of labour. Countries, like people, are most likely to make their improvements in those sorts of production which they already do relatively well than in those they do relatively badly; though not an infallible rule, it is one that is likely to hold unless there is special reason to the contrary. Since it is the things which they make relatively well which they will be exporting, or on the point of exporting, improvements in these industries will be export-biased. But all this means is that the first stage in a process of development is very likely to be export-biased. It is a stage which will be marked by growth of trade, by growth in the international division of labour. Though the division of labour will be limited, in Adam Smith's famous phrase, by the extent of the market—or, as we should say, by the inelasticity of foreign demand—such relative inelasticity is at this stage a stabilizing factor. It prevents the advancing countries from advancing too rapidly in relation to the rest, and thus from upsetting the international equilibrium.

But if our analysis is right, this will, in general, be no more than the first stage of the process. The very improvements upon which the expansion is based set up forces which tend to change its character. Even though the improvements are likely to be made, in the first place, in those countries which already have a comparative advantage for the industries mainly affected, the mere fact that improvements have been made, that the techniques and organization of production have been altered, sets up forces which tend to change the pattern of comparative advantages. It is certainly true that the change which then ensues may take a long time to declare itself fully. Even though the ideal location of production, from the point of view of such things as natural resources and transport costs, has shifted away from the old centres—so that if the whole production system had to be started anew it would no longer be sensible to specialize in the old way—nevertheless the old centres still retain their accumulated skill, and may be able to retain a lead on that basis, even when the geographical factors have turned against them. But once this point is reached, the position of the old centres has become very vulnerable. It has to be expected that some of the countries which were formerly their customers, but which possess the right natural resources for home production of the things they used to import, when production is organized

according to the new methods, will in time acquire the skills which will enable them to compete. When this happens on a large scale, the process passes into its second stage—notice that it is still a stage of development for the world economy, taken as a whole—in which the lead is taken by new centres, which are now making improvements that are import-biased. Thus when our analysis is put into an historical dress, it suggests as a normal sequence the succession of an export-biased by an import-biased phase.

I am no historical determinist; and it is no part of my intention to suggest that historical phenomena will ever fit very neatly into any such logical pattern. But I do think that we see the shadows of such patterns across the face of history. Western Europe is not the first metropolis of trade and industry which has suffered from the competition of the new lands which it has itself developed; there was, I fancy, an element of this same process in the decline of ancient Greece; we ourselves in this island grew great in the fifteenth century and later at the expense of the Flemish and Italian centres on which we had formerly depended. But though such historical examples warn us that the process under discussion is not at all uncommon, they also indicate that there is nothing inevitable about its denouement. After the general expansion of the first phase has given place to the expansion here, contraction there, of the second, it may happen that the troubles of the contracting countries lay so heavy a burden upon the whole international economy that its general progress is brought to a halt. It may happen that the contraction remains localized, and that the expanding centres of the second phase establish a new leadership. It may happen that the centres which have lost their old comparative advantages develop new ones and begin a new expansion of their own. If Professor Postan is right,[1] the history of the Netherlands in the fifteenth and sixteenth centuries affords a remarkable example of this happier outcome.

But I must return to my immediate topic. Whatever the applicability of my analysis to remoter history, its application to the age in which we live is clear and direct. The distinction which I have been making provides a simple and fundamental explanation of the change in economic atmosphere between the nineteenth and twentieth centuries. Once we assume (and such facts as are readily available offer fair direct confirmation of the assumption) that nineteenth-century improvements were mainly export-biased, while those of our day have a predominant bias in the other direction, the whole story begins to make sense. And the dollar

[1] *Cambridge Economic History of Europe*, vol. ii, ch. 4, especially pp. 251–6. The somewhat different version of the story which is told by Miss Carus-Wilson in ch. 6 of the same volume will also repay attention.

problem fits into its place as an episode, albeit a critical episode, in a wider evolution.

It is true that the forms in which the dollar problem has actually appeared have constantly tempted us to regard it as something much less deep-rooted. In the nineteen-twenties it was entangled with war debts; in the nineteen-thirties with world depression and the flight of capital before Hitler; in the nineteen-forties with war damage, more war debts, and the Cold War in international trade. A special explanation of the difficulties which were being experienced by European countries in settling their dollar debts could always be found. But the continuance of the same consequence, the same dollar shortage, as the result of these various 'causes', has by now become very striking. That there is some general influence underlying these particular manifestations can now no longer be doubted. It is hard to see that there is any other general force which would account for what has been happening than the disparity in growth of productivity which we have been discussing.

Looking at our own case, it is no novelty in British history for the development of America to be as important for us as anything going on outside our island. The political independence of the United States did not break the economic links which bound us to them; throughout the nineteenth century the Anglo-American nexus remained a key to the economic development of both countries. The general characteristic of the trade throughout that time was an exchange of the products of American farms for those of British factories. In spite of the high productivity of American manufacturing (which began very early), it was possible for British manufacturers to compete with American on the basis of lower wages; in spite of the high wages in America, Britain could still import American farm-products advantageously to herself, because the exceedingly high productivity of American agriculture kept American farm-products very reasonably cheap. During the age of mainly export-biased improvements this mutually advantageous trade continued to grow. Export-biased improvements continued to be made on both sides of the Atlantic, not indeed quite synchronously—so that the rate at which the gain from trade was increasing swung sometimes to one side, sometimes to the other—but evenly enough to ensure a continuing gain to both sides. Especially in the railway age, when nearly the whole of the United States and much of Canada were made into possible sources of exports, British dependence on North American agriculture was carried so far as to be a major characteristic of the British economy.

The time came (probably it had to come) when the rate of growth of productivity in Britain fell behind that in America. This in itself, as we have seen, must have caused monetary difficulties—manageable so long

as the discrepancy remained small, serious as it became wider. In the first phase of the dollar shortage (say the nineteen-twenties) the difficulties which arose may indeed be said to have been almost exclusively monetary. So long as British wages (under the restored gold standard) remained fixed in terms of dollars, British industry found difficulty in competing with American; but the productivity of agriculture (in North America and elsewhere) was still increasing so rapidly that a moderate devaluation would have restored our earning-power without imposing more than a very temporary sacrifice upon the British consumer. Thus at this stage it was quite right to think of the problem in monetary terms—to analyse it as Keynes did in fact analyse it at the time.

Since then things have become more difficult, mainly because the rate of growth in productivity in agriculture has slowed up. As things are today, it may still be necessary to reduce the dollar value of British wages in order to keep British manufactures competitive with American manufactures, but we can no longer count upon the real sacrifice involved being slight or temporary. Increasing productivity of our agricultural suppliers can no longer be relied upon to come to the rescue. If a monetary adjustment is needed to keep trade in balance it now requires a fall in British wages in terms of British imports, or a rise in the prices of British imports relatively to British wages.[1]

It is still true that the core of the whole matter is to find a way of paying for the agricultural imports from the United States and Canada (raw materials as well as foodstuffs) on which the standard of living of the British people has come to depend. It has long been impossible to pay for them, save to a small extent, by direct export of British goods to the 'dollar area'. For this the American tariff must bear some part of the blame; but since the same difficulty is felt in Canada as in the United States, it is clear that the increasing productivity of American industry must be regarded as mainly responsible. Yet even when the mass export of British goods to America became a thing of the past, it was still possible for us to pay for our imports from America by triangular trade. America still requires some products (tropical and mineral) which she cannot produce within her own borders; if America will buy from (say) Africa and Africa will buy from Britain, Britain can still buy from America and

[1] The particular mechanism by which the relative rise in import prices is transmitted to the British consumer is an internal question, rather independent of the main conclusion. It is possible that the prices of imported goods may just be allowed to rise on the home market; or their prices may be kept down by subsidy and the demand for them kept down by rationing. If sufficient taxes are imposed to offset the effect of the subsidies, the difference between the two techniques is a matter of the internal distribution of the burden which has to be endured. For an admirable study of the relation between this burden and the others under which post-war Britain has laboured, see Harry Johnson, *The Overloaded Economy* (University of Toronto Press, 1952).

pay for what she buys, handing on the 'dollars' which she has received from Africa. But this indirect solution, though we have come to depend upon it, is itself threatened by the same forces as destroyed the bilateral balance. Unless British manufacturers can compete with American in the markets of third countries, trade between these third countries and America will settle down into a bilateral exchange of third-country products against American manufactures, with Britain left out in the cold. Political influence, and propaganda based upon the alleged 'instability' of the American market, will fight a losing battle unless British exports are competitive, unless (that is) the triangular trade is more advantageous from the point of view of the third countries than direct bilateral trade with America would be. Though protective devices may do something to put off the evil day, the trend is bound to be in the direction of American–'African' bilateralism, unless British costs fall as fast as American costs may be expected to fall.[1]

If the rate of increase in productivity in British export industry falls behind that in American export industry, British costs can only remain competitive if there is a fall in British wages relatively to American wages, when both are measured in the same currency. But if the costs of American and Canadian farm-produce are not falling in terms of American wages, this must mean that the British consumer is made less able to buy the North American farm-produce to which he has become accustomed. This, again, would not much matter if there were other suppliers of farm-produce which were making export-biased improvements, so that the imports which were becoming harder to get from North America could be replaced from other sources at a cost which was not getting out of reach. But in a world where improvements are turning import-biased, such relief cannot be taken for granted. Thus the change in relative wages, however it is brought about (whether directly, or by some monetary trick such as devaluation), must be expected to mean a real loss for the British consumer.

This, of course, is the real reason why the devaluation of 1949 was a failure. It was put over as a trick which would enable the balance of payments to be righted without real sacrifice. Thus when the sterling

[1] In making the above statements, I am begging the much-debated question of the world elasticity of demand for British exports, which I assume (in opposition to much important opinion, and to some alleged evidence) to be quite high. I must therefore emphasize (1) that I am talking about long-run elasticity, which all would admit to be higher than short-run elasticity; (2) that for the 'curve' to be elastic upwards—so that a moderate excess of our prices over those of our competitors will cause us to be pushed out of the market—does not imply that it is elastic downwards—for the domestic producer may well secure additional protection if his market is invaded too drastically. The theory of the 'kinked demand curve' may well have a more important application to international trade than to other branches of economics.

prices of imported commodities began to rise in order to enforce a real sacrifice, wages chased after the rising prices, and the rise in wages made the devaluation largely ineffective. If we devalue again in the same delusion, the same thing will doubtless happen again, and may happen even more quickly. Along that road there is no way out.[1]

If the rate of growth of productivity in British industry remains behind that in American industry (and it would be optimistic to hope that such a disparity can now be avoided), there is no way of avoiding a long-run fall in the British standard of living *unless our essential imports become easier to get*. Improvements in primary production have now become quite vital to us, but they will help us wherever they occur. If they occur in North America itself, they will help us to acquire supplies from America by offering them to us at a reduced cost in terms of American wages; if they occur in this country, they will make it possible for us to reduce our imports without sacrifice; if they occur in other countries, they will enable us to replace our imports from North America by imports from these other countries, which will then be offered to us on more favourable terms. But all these are in a sense part of the same problem; it is only by some kind of attack upon that problem that we can hope in the end for a solution of our difficulties.

The present check to the process of cost-reduction in world agriculture is partly a consequence of the long-run forces which I discussed at an earlier point of this lecture; but it is due in part to causes which may be of a more temporary character. Some of these are political causes, which I shall not attempt to consider; but there is one that is economic, and which deserves a mention because it may be removable. It is the common fate of all large-scale agricultural improvements to run up against obstacles (perhaps temporary obstacles) to the profitable disposal of an increased product. But even in cases where it is quite impossible to increase sales by lowering prices, reductions in cost remain desirable in the general interest of economic progress, since they enable a given product to be produced with a smaller application of resources (usually, with less labour)

[1] In a world of full employment and cost-of-living inflation, the above is the strongest objection to the devaluation 'remedy'; but I do not desire to suggest that it is the only objection. To adjust the value of money as a once-for-all measure to meet a single identifiable change (such as that caused by a world war) seems to me to be one thing, a continuing policy of depreciation, to deal with a continuing failure of competitive power, to be quite another. If currency depreciation is adopted as a regular policy, people must come to foresee it. If they do so, they will decline to hold the depreciating currency; for it is more profitable to hold a stable money than one which is depreciating. Even though the 'soft' currency is fortified by exchange restrictions, the objection is not wholly met; for it is doubtful if any practicable exchange restrictions will suffice to protect a currency, depreciation of which has become a habit. In our own case, in view of the advantages which we gain from the use of sterling as an international medium, this argument is particularly powerful. We may be put to great straits in order to maintain the exchange value of sterling (at least to the outsider); but I doubt if we have any alternative but to bear our cross.

and accordingly set labour free for increased production of other things. Nevertheless, in the short run, while unnecessary numbers of workers are attached to the production in question, the incomes of producers are abnormally low. The consumer is then deriving an advantage, not only from the technical reduction in cost (this is an advantage to which, in a sense, he is entitled), but also from the temporary lowness of the producers' incomes (and the gain which he gets from that is hardly one to which he is entitled in the same sense). Throughout the twenties and thirties agricultural incomes were abnormally low from this cause; and the British consumer derived a corresponding advantage, which masked the weakening of his own economic position. He has now lost that advantage, as he was bound to do sooner or later; but he has not merely lost an advantage—he is suffering from a disadvantage that runs the other way. Primary producers, through their own organizations and through their governments, are taking measures to protect themselves from further over-production; but in so doing they are slowing up the cost-reducing process itself. The arrested development of world agriculture is therefore not wholly natural—it is in part contrived; importing countries could hardly be blamed if they reacted against such contriving in any way that was open to them. Our own bulk purchase of agricultural supplies has in fact been used for the underpinning of the 'stabilization' schemes of primary producers, though stabilization of supplies is against our own interest. It might not be impossible to make some agreements in a form which would encourage increases of production from particular regions;[1] even though the costs of such a policy were for a time considerable, it might be sensible to make some sacrifice for it if it helped to break the jam and gave us a better prospect for the further future.

But this is no occasion for policy recommendations, and I should like to conclude upon another note. In the historical survey with which I began I omitted to pay the customary tribute to my immediate predecessor, Sir Hubert Henderson. The reason why I did not pay it in that place was because I proposed to express my debt to him in another way. Those who knew him as I came to know him will recognize his influence upon what I have said in the body of this lecture. Though I have been putting it, and working it out, in my own manner, it is his teaching which I have endeavoured to express. It was partly in order that I might find this way of recalling him to your remembrance that I chose to speak on *his* problem—on the problem which came to be his chief concern and which he was perhaps the first of British economists to understand.

[1] I am thinking, for instance, of the proposals put forward by Mr. Kaldor (*Economics of the International Wheat Agreement*, F.A.O. 1952).

IMPERFECT KNOWLEDGE AND ECONOMIC EFFICIENCY

By G. B. RICHARDSON

I. Introductory

I AM concerned in this paper with the imperfection of our knowledge as economic agents, with its influence on the nature of the economic system, and with its relevance to the way in which the system should be appraised.

In saying that our knowledge is imperfect I mean that it is fragmented and that it is uncertain. It is fragmented in that each of us knows only a very small part of all that is to be known, though individual fields of vision may overlap; and it is uncertain in that much of what, in this paper, I shall loosely term 'knowledge', is of the form of personal estimates or opinions which may differ and which cannot be shown at the time to be certainly true or false.

The economic problem is concerned with the adaptation of means to ends. In our theoretical representations of it we normally take the means —factors of production and techniques—and the ends—consumers' preferences, the 'social welfare function', and the like—to be known or 'given', and proceed from there to deduce what the general conditions for optimum allocation will be. Now there is a danger that this purely logical problem of drawing appropriate conclusions from given premisses may be regarded, perhaps implicitly, as an adequate description of the actual problem with which our economic system is concerned and from which it derives its rationale. This is, however, very far from the case.[1] The practical problem which our theoretical system would most closely represent would be that facing a single mind to which all the relevant knowledge regarding means and ends were known with certainty and as a whole; that which confronts us is entirely different. Knowledge, in the world as we know it, is neither centralized nor certain, but is dispersed, frequently in the form of subjective and even conflicting estimates, among many minds. In consequence, the actual economic problem is more fundamental and more complex than the theoretical problems of formal welfare economics; its essence is not the allocation of 'given' resources among 'given' ends, but the integration and improvement of our knowledge regarding them; it is concerned, in other words, to ensure that the fullest use will be made of the relevant knowledge which is dispersed among many minds and that the estimates

[1] *Vide* Professor Hayek's most stimulating article, 'Economics and Knowledge' (*Economica*, 1937), which has greatly influenced the views advanced here.

according to which allocative decisions are taken will tend in the long run to be the best available.

The principles of welfare economics are sometimes regarded as applicable directly to economic policy, in that they afford to the government and to the entrepreneur a body of rules to which their decisions ought to conform. This is an entirely mistaken conception, responsible for much of the misunderstanding and misapplication of welfare economics. The optimum conditions of production and exchange do not represent injunctions on how a certain outcome can be attained, but criteria by which the realized outcome can be appraised. They are conditions which an efficient economic system will have to realize to the greatest possible extent *ex post*, but imply nothing whatever regarding the nature of the economic decisions which the component individuals must take in order to bring this about.[1]

There is, however, one circumstance which would justify us in regarding the appropriate rules for the conduct of economic activity and the appropriate criteria for appraising its outcome as identical; that is the existence of perfect knowledge. In a world where expectations never erred, optimum allocation would be reached if entrepreneurs were to implement the welfare principles as if they were rules relating to *ex ante* magnitudes; that is to say, if we take Lerner's Rule as representative, provided they produced at an output such as would equate expected price with expected marginal cost. Whenever we relax the assumption of certain expectations, there remains no logical presumption that the universal implementation of the Rule is the best way of obtaining the required outcome. To prescribe as if there were such a presumption is to assume that individual estimates of the future values of economic variables are objectively correct or at least the best available and that the distribution of productive resources among those who dispose of them must be regarded as optimal; it is to assume, in fact, that a crucial part of the economic problem has already been solved. For there is the question not only of how to allocate but of who is to allocate, or, in other words, of how the system is to allocate capital between entrepreneurs. The economic system, we might say, has a selective as well as an allocative function; both are relevant to its efficiency, although addiction to models assuming certainty has perhaps led some of us to devote to the former very scant attention.

There is, of course, a variety of ways in which the economic units which are to have command over resources may be selected, but I shall confine myself to one broad distinction: to that between selection which is planned and selection which is automatic. The classification is rough but, I hope, serviceable; selection is planned when one man or authority deliberately

[1] *Vide* Hicks, 'The Foundations of Welfare Economics' (*Economic Journal*, 1939).

chooses another to exercise command over resources; it is automatic where an economic unit gains or loses command over resources according to its success in making profits and to the facility in borrowing which reputation, created by success, engenders.

In this paper I shall endeavour to analyse some of the ways in which our economic system secures, to a greater or less extent, the integration and improvement of our knowledge. Some features of the system which, in over-simplified models, might appear as imperfections will, I hope, be shown to fulfil an indispensable function: either, by providing a form of communication, of overcoming the division of our knowledge; or, by constituting an environment favourable to efficient selection, of securing its improvement.

A warning is perhaps appropriate at this stage. I shall later be maintaining that free enterprise works rather better, in certain respects, than judgement of it based on a superficial understanding, and consequent misapplication, of the welfare principles, would suggest. I am at pains to emphasize the limitation 'in certain respects'. No opinion on the general efficiency of free enterprise can legitimately be formed without thorough study of important issues entirely excluded from discussion here; the dangers of oscillation and of harmful speculation, oligopoly, and the divergences between private and social cost of the type discussed by Professor Pigou, are among the most important. The ethical value of particular income distributions is likewise outside my scope, although I shall have something to say on their indirect influence on the structure of the economic system.

II. The nature of probability estimates

I now wish, at the risk of breaking the continuity of my argument, to interpolate some observations on the nature of the estimates or opinions which form a large part of our imperfect knowledge. A full discussion of the nature of estimates of probability would be both beyond my competence and unnecessary to the purpose at hand; but it is perhaps desirable to refer at the outset to the well-known distinction, drawn by Knight, between 'measurable' and 'unmeasurable' uncertainty, or, to employ his other terms, between risk and uncertainty, or between objective and subjective estimates of uncertainty.

Knight used the word 'risk' to denote statistical estimates of probability, that is estimates based 'on empirical valuation of the frequency of the association between predicates'. 'Uncertainty' was used in connexion with estimates of probability which were made, he argued, 'without there being a valid basis of any kind for classifying instances', the future event considered being for practical purposes unique. When dealing with risks

proper, according to Knight, it would be possible, by grouping sufficient instances, to approach complete certainty. This was not possible with true uncertainties, although there was 'some tendency for fluctuations to cancel out in some degree'.

Now many writers have argued that the difference between risk and uncertainty is one not of kind but only of degree, depending on the homogeneity of the classification into which we fit the instances in question. No future event is ever wholly unique, neither is it ever identical with a past event. Where we can obtain relatively homogeneous classes without reducing overmuch the number in the class, fairly good estimates of the parameters of the probability distribution can be obtained and, for that reason, grouping as in insurance may be possible. Where the instances can be fitted only into the roughest of classes, only very approximate estimates are obtainable. If the future event is not known to resemble a past event in any way, nothing can be said.

Now, while it may be true that the results of probability estimates of all kinds are different not in kind but in degree, there is an important difference in the ways in which they are made, a difference which is of definite significance for social organization and which represents the essence of the distinction which Knight, I believe rightly, thought so important. Certain things can be done by following exactly a fixed set of rules, whereas others require a specific skill, innate or acquired, and more or less particular to the performance in question. Given a map and good directions most people could find an address in a city, but the fullest instructions will not enable us, without acquired skill, to drive a car or to play tennis. We may, indeed, in these cases suggest a few precepts, but they will far from suffice to ensure success; while a person may possess the skill without being able to formulate the precept.[1] There is clearly something of this kind in the distinction between Knight's two forms of probability estimates. Some estimates are made by applying those known rules which constitute the body of statistical knowledge; others are not so made but require a flair or specific skill. Estimates of this latter type are by far the commonest; they are continually being made and are no more mysterious than any other skilled performances which cannot be done merely by following a set of rules.

Now what is important in this distinction from our point of view is that the first type of estimates, statistical or objective estimates as we may call them, are demonstrable: the procedure by which they are reached can be written down and codified. They can be made quite objectively, in the sense that the calculation is in no way private to the calculator. Thus if I am informed by someone that a statistical probability is of a certain

[1] *Vide* Ryle in 'Knowledge How and Knowledge That' in *The Concept of Mind.*

order, I should believe him, provided he knows how to apply the rules to the material, can do arithmetic, and is not telling lies. It may be that because the past estimates are few in number the figure is exceedingly rough, but it is objective in the sense that, given the same information and the same rules, everyone should get the same result. Estimates of the second and more numerous class, subjective estimates as we may call them, are not like this. There is no way in which the rationale of their calculation can be fully demonstrated or communicated; one cannot accept the validity of another's estimates with only those reservations which were made in the case of objective estimates, but must have formed an estimate of the person's foresight in this direction, either on the basis of his past performance or on experience of men similar to him. The estimate is private to the estimator and in this sense subjective.

This distinction between subjective and objective estimates has, as I hope to explain later, an important bearing on the nature of the social organization which has grown up as a means of overcoming the obstacles to economic efficiency created by the imperfections of our knowledge.

III. The organization of the capital market

Let is now return to the main course of the argument. I have said that it is characteristic of knowledge in this world that it is dispersed among many minds and that much of it is in the form of subjective and uncertain estimates. Yet society exists; the fragments of knowledge are so integrated and utilized that ends of great complexity are achieved. The mechanisms or processes which make this possible form perhaps the main object of the study of the social sciences in general: we are concerned with the economic aspects, and in particular with the means by which resources are allocated in the free economy, given imperfect knowledge.

Let us first suppose that knowledge, though fragmented, is certain. In this case it is the price mechanism, as ordinarily conceived, which secures integration. The invisible hand of the classical economists is normally regarded as harnessing the forces of self-interest in the service of the general good; by virtue of the division of labour and of exchange, ends are achieved which, though socially desirable, form no part of the intention of the participating agents. In fact, however, the invisible hand, or the homoeostatic controls of society, as it might nowadays less picturesquely be termed, fulfils a yet more fundamental function: it acts as a method of communication, and by integrating the knowledge which is dispersed in many minds, enables society to work as a whole.

The way in which this is done is widely familiar; if, for example, a factor becomes more useful in a particular employment, its price will be bid up, its use in other employments thereby curtailed, and an incentive created

for the use of substitutes. The allocation effected by the perfect competition model does not therefore require that the information of economic agents should be complete; indeed, the essential point of the system is that it overcomes these individual limitations in knowledge. For example, if we consider the allocation of a factor with a given price between uses *A*, *B*, and *C*, there being two agents *X* and *Y*, it is necessary that each agent knows two uses only, provided they know one in common. For then, assuming knowledge to be certain, *X* will ensure that the marginal products of the factor will be equal, in value terms, in *A* and *B*, and *Y* that they are equal in *B* and *C*. Thus the marginal product of the factor will be equal in all three lines. The number of products may be extended indefinitely; each person need only know a limited part of all that is to be known, provided that their individual fields of knowledge overlap. It ought to be possible to prescribe the minimum knowledge which each individual must possess, in order that rational allocation throughout the economy may be achieved or approximated to, but I shall not allow this rather difficult question to detain me here.[1]

If we allow our economic agents to be endowed with perfect honesty as well as perfect foresight, the optimum allocation of capital among borrowers likewise presents no difficulty; provided lenders' fields of knowledge overlap appropriately, the marginal yield of capital will, in equilibrium, be equal in all directions. But whenever we relax our assumptions and allow knowledge to be uncertain as well as fragmented, in the form of subjective estimates, the situation radically alters. Both the commodity market and the capital market will assume a character different from that of the model based on certainty, but it is the capital market, related as it is to estimates of an essentially uncertain future, which suffers the greatest change. The marginal yields or efficiencies of capital are now, in their relevant sense, merely opinions and should not be considered independent of the mind or minds by which they are entertained; they will tend to equality in the mind of each investor who is able to form the relevant estimates, but not in any more general or objective sense.

The question therefore arises as to how, and with what degree of rationality, capital is allocated under these conditions. Let us first consider the relationships which would obtain if there existed only entrepreneurs, with or without capital of their own, and persons who lend directly to them. If there were no borrowing, the amount which an entrepreneur would invest in any line would depend on his expectation of the profit rate in it relative to that of other lines with which he was familiar; it would be limited ultimately by the quantity of capital in his possession, but more immediately by considerations of risk, that is by the desirability of diversifying

[1] *Vide* Hayek, op. cit.

his assets and of avoiding excessive illiquidity. (The relationship between liquidity and the imperfections of our knowledge will be more fully discussed below.) In other words, investment in any line is limited by the fact that the entrepreneur's estimates of its profitability are uncertain, and by the fact that others cannot be assumed to share his estimates, so that, if it happened that he were forced to sell his assets, he would probably do so at a loss.

The possibility of borrowing does not radically alter the situation. An entrepreneur can obtain funds to a limited extent on the security of his own capital, and also in such measure as lenders hold, or can be persuaded to hold, views about the profitability of the venture not much less confident than his own subjective estimate. One may expect that the wider the circle of borrowers an entrepreneur approaches the less will be the knowledge of his ability and projects, and the greater will be the incentive necessary to induce lending. Nor will the borrower always be able to satisfy his demands within the narrower circle of those who can form good estimates of his projects, for the amount which any single investor will be prepared to lend to any one borrower will also be limited by the needs of diversification and liquidity. Thus risk will increase with investment for a variety of reasons. The well-known Law of Increasing Risk enunciated by Kalecki is a corollary of the fact of the imperfection of our knowledge, of both its uncertainty and its division.[1]

For any firm, therefore, there will be a gap between the marginal efficiency (by which I mean the mathematical expectation or best estimate of the yield) of the capital invested and the rate of interest at which it borrows. This gap will increase with the scale of the investment, depending, *inter alia*, on the uncertainty of the expectation—as measured, for example, by the dispersion of the probability distribution of expected profits, the liquidity of the assets, and the proportion which they bear to the capital borrowed. There will also be a gap between the rate at which the firm borrows and that on approximately riskless securities, such as treasury bills, the size of which will depend of the lender's liquidity preference in the Keynesian sense, that is on expectations regarding future rates and on the needs of convenience and safety, as well as on the lender's estimate

[1] It is not true that increased fixed-interest borrowing will always increase the risk to the investor by reducing the ratio of own to borrowed capital. There may indeed be decreasing risk over a certain range. This will be so as long as the riskiness of the venture decreases more with the total quantity of capital employed than it increases with the proportion of own to borrowed capital. It might be, for example, that the minimum practical scale of operations would leave the entrepreneur with a very small cash reserve or simply that increased scale reduced average cost. In either of these cases borrowing might well reduce the riskiness of the venture. This, however, will merely serve to postpone the operation of the so-called law, for the risk inherent in the increased ratio of borrowed to own capital must eventually, in any likely circumstances, offset the reduction in risk which the increased scale of operations, made possible by borrowing, brings with it.

of the marginal efficiency of capital in the borrower's business—for on this will depend, in the case of debentures, the likelihood of default, and in the case of equity participation, the yield.

It can be seen that many of the risk factors associated with investment affect both gaps or margins; that is, both the margin between the marginal efficiency of capital, as conceived by the entrepreneur, and the borrowing rate; and between the borrowing rate and the bill rate. Keynes referred to this when he distinguished between borrower's and lender's risk. 'The first', according to Keynes, 'is the entrepreneur's or borrower's risk and arises out of the doubts in his mind as to the probability of actually earning the prospective yield for which he hopes. If a man is venturing his own money this is the only risk which is relevant.' Lender's risk 'may be due to moral hazard . . . or to the possible insufficiency of the margin of security'. Keynes goes on to argue that 'the first type of risk is in a sense a real social cost. . . . The second however is a pure addition to the cost of investment which would not exist if the borrower and lender were the same person. Moreover it involves in part a duplication of a proportion of the entrepreneur's risk, which is added twice to the pure rate of interest to give the minimum prospective yield which will induce the investor' (*General Theory*, p. 144).

It seems to me, however, to be misleading to say that only the borrower's risk was a 'real social cost'. For this to be so the borrower's estimates would have to be in some sense objectively correct, which of course we have no right to assume. The uncertainty of a venture and the real social risk depend presumably on the probability of success as estimated by the entrepreneur and the probability that the entrepreneur's estimate is correct. The former, though no doubt very imperfectly, is reflected in the borrower's margin; the latter in the lender's margin. For if the entrepreneur is untried his estimates are prima facie less reliable than those of the successful entrepreneur, and the higher rate at which he borrows should to some extent correspond to the greater social risk of lending to him.

It is apparent, therefore, that even in this simple model, to regard the level of investment as determined by the equality of the marginal efficiency of capital and the rate of interest involves exceedingly drastic simplifications. The rate of interest, as everyone knows, is a high abstraction like the price level, for there is no single rate at which all can borrow. But even if this be recognized, it is still not true that the marginal efficiency of capital and the borrowing rate, whatever it is, will be equated. Neither can one avoid this difficulty, as is sometimes attempted, by assuming that the borrowing rate will equal the marginal efficiency of capital, discounted by a risk premium varying with the dispersion of the probability distribution

of the yield; for we have seen that the borrower's margin depends on factors other than this dispersion, factors which should properly be made explicit.

Now it is clear that a capital market such as we have pictured it, comprising only owners of capital and those who ultimately employ it, would impose severe limits to the level of investment, both of each individual firm and of the economy as a whole; for the probability that an entrepreneur will be in touch with an owner of wealth who shares, or is prepared to take on trust, his estimate of the prospective yield of a venture will not be high. Many owners of wealth might indeed be unable to form an estimate of any investment project. The principal ways in which in actual markets the difficulties thus presented by the division of knowledge are substantially overcome are, of course, the growth of established business reputations and the existence of intermediaries.

Certain enterprises will be more successful than others; the fact will become known and lenders who lack more direct knowledge of ventures and men will entrust their funds to them on the strength of their reputation. The increased facility in borrowing will allow the firms to expand and secure their position, so as to further improve the terms on which they borrow. The growth of bonds of reputation and goodwill, far from being an imperfection, is an essential pre-condition of the transfer of investible funds, and I shall be concerned below with the environment favourable to it, for it is upon the ways in which reputations are gained or lost that the rationality of the allocation will depend. The function of reputation and goodwill, in common with that of conventions and customs, is to save us from the need of doing afresh all the thinking which has been done by our predecessors. They enable us to assume that there are prima facie reasons for something being the case, and thereby save us the trouble of having to investigate. This they do in a most rough and ready way; sometimes they lead us astray so that we are forced to rethink the matter for ourselves. But unless very frequently wrong, they are justified as economizing in thought, in enabling us to act in the world without having to think everything out from the beginning; and, as this would be beyond our powers, in securing thereby that society works despite the imperfections of our knowledge. Thus, for example, the fact that established firms can borrow more cheaply than those without a reputation is not necessarily a defect in the system; it may be the method in which resources are allocated in the directions in which the objective probability of their being best employed is highest.

Borrowers who have acquired a reputation need not themselves have to employ the money entrusted to them, but might lend it to others, thus interposing a class of intermediaries between the original suppliers and

final users of funds. Ultimately the gaps produced by the division of our knowledge would be spanned by a complex network of intermediate borrowers and lenders each possessed of established reputation *vis-à-vis* those from whom they borrow, and of special knowledge of those to whom they lend. The conclusions reached above regarding the diversity of interest rates and the nature of borrower's and lender's margins remain essentially correct although the relationships are now more complicated. There will now be a gap between the lender's and the borrower's rate sufficient to compensate the intermediaries for their reputation and special knowledge, but the margin between the lender's rate and the bill rate will be sufficiently narrowed for the whole difference between the bill rate and the borrowing rate to be reduced. If it were not, of course, the direct channel would be used in preference.

I have been attempting to sketch, in roughest outline, the relationships which will obtain between borrowers and lenders on the assumption—the realistic assumption—that knowledge of investment opportunities was in the form of individual subjective estimates each covering only part of the field. In what way can we appraise the efficiency of these relationships as a mechanism for allocating resources between industries and firms? There exists, of course, the formal criterion that the marginal efficiency of capital should be the same in all directions. Thus, for example, Mr. R. F. Henderson proposes at the beginning of his recent empirical study of the New Issue Market that there should be 'equality of cost of finance for comparable real investment' and that 'all firms should get finance for real investment with a prospective yield above a certain level, after allowing for real risk'. Now, while this criterion is valid, it is difficult to see how it is to be applied. For we simply do not possess, *ex ante* or even *ex post*, objective estimates of the marginal efficiency of capital in every firm and industry in which it might be employed; there exist only estimates which are subjective, and may be conflicting. If we assume that the estimates of all business men, regardless of the differences between them, are the best available, we assume in fact that the capital market has already performed its primary function. The efficiency of a capital market will depend in practice on the extent to which it is likely to secure that the estimates on which investment decisions are taken will tend to correct estimates, which is mainly a question of the efficiency of the system in selecting those who are to make investment decisions; on the extent to which it provides the incentives necessary to induce these people to allocate according to their estimates; and, finally, on differences between private and social costs of the type with which we are familiar, but which are not discussed here. Seen from this point of view, many aspects of the capital market which, if we apply directly the criteria appropriate only to perfect

knowledge, appear to be imperfections, or, as Mr. Henderson calls them, 'distortions', are seen to be in fact essential to the integration and improvement of the knowledge on which decisions are based.

That the market functions as a selective mechanism, and thereby improves the knowledge on which decisions are taken, is, of course, widely recognized, though I am inclined to think that in appraising its efficiency too little attention has been paid to this. Under capitalism, ideally, and to some extent in practice, the power of disposing capital will be given to those who have disposed it well in the past; successful exercises of entrepreneurial skill will produce profits which will themselves form the capital available for further investment, and will generate reputation which facilitates borrowing. Failure, on the other hand, will deprive the unsuccessful entrepreneur both of his capital and, ultimately, of his reputation. It is worth noting here that, whereas if free competition is conceived merely as an allocative mechanism only the ordinal magnitudes of profits in each line are regarded as significant, it is the cardinal magnitudes which are important in securing that those who have been successful in allocating resources in the past will obtain extended control over them in the future. Now it hardly needs saying that the selective mechanism of free competition is far from perfect; the bequeathing of private fortunes has the result that people start the race with different handicaps, and there are all the divergences between private and social cost and the dangers of speculation and oscillation which I am excluding from discussion here. But that it has worked in a rough and ready way, the existence of our highly complex industrial society seems to testify. The free economy has been lauded, sometimes rather ingenuously, for the way in which it solves millions of simultaneous equations; but in fact it does more than this: it sets up forces such as help to ensure that in the long run, and by and large, the estimates on which decisions are taken are likely to be the best available. It is important to realize that the capitalist economy does this, whether or not one believes that an alternative form of economic organization would do it better.

IV. The conditions of efficient selection

I have argued that the efficiency of an economic system will depend, in the long run, not only on the quality of the allocation of resources achieved relative to the existing estimates, but also on the quality of the estimates themselves; that it depends therefore on the forces influencing the selection of entrepreneurs. It is to the general environmental conditions most favourable to the successful operation of this process of automatic selection that I now wish to turn.

We have already noted the absence of any general presumption that the

decisions of entrepreneurs regarding the level of price and output which will effect the optimum allocation when knowledge is perfect, are the same as those most likely to do so when it is not; it can, I think, be shown that, if an environment favourable to selection is to be maintained, they will in general be different. Provided we continue to make the radical assumption that private profit and general benefit coincide, efficient selection would seem to require that an entrepreneur's control over capital should increase or decrease according to his success in the ventures in which he is engaged, for this would provide grounds for believing that he would continue to allocate capital successfully in the future. A single divergence of a realized outcome from the most probable expectation of it would, however, not provide reliable evidence of poor estimating ability; it might, for example, represent a result which the entrepreneur considered quite possible though not very likely, and even if he had forecast badly on this one occasion, only a very weak presumption exists that he will continue to do so in the future. An entrepreneur will in general be able to show himself to have or to lack foresight only if he is permitted to have several chances of exercising it, that is to say, only provided a single deviation of the realized value of any variable from its mean expected value does not remove him from business. If therefore we are relying on the process of automatic selection, there will be an optimum degree of responsiveness of the viability of the firm to errors of prediction on the part of its manager; for efficient selection will be prevented equally by an over-sensitive as by a sluggish reaction. It is important that not only should sustained miscalculation remove a firm from business, but also that a few errors should not; for even if business men were prepared to undertake any uncertain ventures on these terms, which is unlikely, few firms would survive for long: the absence of continuity and order in the ownership and control of resources would involve great social cost, and without the evidence which only long-run performance can provide, valid estimates of entrepreneurial capacity could not be formed and reputations could not grow.

The optimum degree of stability would, of course, be that which brought the realized long-run performance of the system most into conformity with the ideal allocation prescribed by static welfare economics. It would, however, be very difficult to appraise performance, and *a fortiori*, hence to estimate the appropriate degree of stability: information *ex post* about the realized values of price and marginal cost and the returns of capital in various employments would not suffice, for it would not tell us, for example, how many opportunities for investment were missed. There is certainly no presumption that, with a given degree of unavoidable uncertainty in forecasting, the optimum degree of stability will be obtained in a system of unregulated competition, in which entrepreneurs took the same price

and output decisions as they would if their best estimates of economic variables could be regarded as certain. Business men do not act, however, in this way, and many of their policies, however motivated, do succeed in reducing the risk inherent in economic activity, and they may thereby derive at least partial justification, even when they are in contradiction with the formal welfare principles. A reduction in risk and a consequent gain in economic stability will be obtained by weakening the chain of connexion between the accuracy of the entrepreneur's foresight and the survival of his firm, and to do this it is necessary to damp either the effect of errors of estimation on current profits or the effect of current profits on viability. The following section presents a very summary analysis and appraisal of some of the ways in which this can be done: first, I shall deal with the holding of liquid assets in order to mitigate the effect of fluctuating profits; secondly, with price and output decisions designed to limit the effect on profits of possible shortfalls in demand; and, thirdly, with the reduction in risk secured by the grouping of several ventures.

V. The reduction of risk

1. Liquidity. It is well known that a single business loss may involve the entrepreneur in further secondary losses, by obliging him to make a forced sale of his assets; if therefore a firm is to survive in the face of fluctuating receipts or costs, it is important that this multiplier effect should be minimized.

The size of this 'multiplier', that is the relation between the primary and the total loss, will depend on the liquidity of the owner's assets, which I shall define as the value in sale he expects from them divided by the valuation he himself puts upon them. By 'expected value in sale' I shall mean the price in terms of money of constant purchasing power the owner expects the assets will fetch, less an allowance representing the expected cost and delay of finding a purchaser, as measured by the quantity of money just sufficient to compensate the owner for the disadvantage entailed. By the owner's 'own valuation' of the asset I shall mean the amount of money just sufficient in normal circumstances to persuade him to part with it.

It will be observed that this definition is wholly subjective, which is as it should be; for as we are concerned with the liquidity of assets as a determinant of the owner's decisions, it is his estimate of their selling price and their value to him which are relevant. Moreover, liquidity in this sense is also relative to a particular point in time, though it might be convenient to refer to an asset as possessing a certain degree of liquidity to the extent that its owner expected it to possess this liquidity at any foreseeable date. I am aware of deficiencies in this definition; by

introducing the idea of 'normal circumstances', for example, it is not quite determinate. But the whole notion of liquidity is surely one of the most imprecise and fugitive in economic theory, and the above definition seems to best represent that aspect of it which is relevant in this particular context.

Illiquidity, thus conceived as depending on the relation between the owner's valuation and that of other people, arises principally because of the imperfection, and especially the division, of our knowledge. In the case of a share or security the owner may simply take a more optimistic view of the asset's prospective yield than do others, and his view may or may not be based on particular knowledge available only to him. Or it may be that, in the case of a machine or plant, he believes the asset to be complementary with others in his possession, including his own skill and entrepreneurial capacity. It is true that in this case the entrepreneur would find it more advantageous to borrow on the security of his assets than to sell part of them, but the availability and cost of credit will also depend on how far others share his estimate of their value, that is to say, on their liquidity. In general we may say that the assets of an entrepreneur will be illiquid; that is to say, his own valuation will exceed that of the market, if only for the reason that it was precisely because he expected their yield to exceed the current normal yield that he purchased them, and, the more illiquid the asset, the higher will be the return which the entrepreneur will normally expect from it.

According to the definitions which I think are most convenient, imperfect marketability is a cause of illiquidity but not identical with it. An asset may be said to be marketable if it can be readily bought or sold, that is to say, if it is in sufficiently constant demand for buyers to be in close and continual contact. The degree of marketability will be measured by the ratio of the value in sale, as defined above, to the buying price; the degree of liquidity by the ratio of the former to the owner's own valuation. The marketability and the liquidity of an asset will therefore be equal only when its owner's valuation equals its buying price; but it is only in the exceptional case of the marginal unit of a completely divisible asset that this equality will exist. Marketability is neither a necessary nor a sufficient condition for liquidity; an asset may be marketable but illiquid when its buying price equals its selling price but is less than its owner's valuation, and may be liquid but unmarketable when its selling price approximates to its owner's valuation but falls below its buying price.

We are concerned with the liquidity of an entrepreneur's assets as a factor diminishing the multiplier effect of an initial loss, and therefore as a way of reducing risk and increasing economic stability. Most economic units will experience a continual ebb and flow in their receipts and payments,

the exact magnitude of which will not be foreseeable; the direction of the net flow in the long run will determine the chances of survival and of growth, but many of the fluctuations will be self-cancelling. Were there perfect knowledge these fluctuations could be met by loans advanced by the units in temporary surplus to those in temporary deficit; but as there is not, and as the cost of bridging the gap by a network of intermediaries might sometimes be prohibitive, the need is frequently better met by the holding of liquid assets, and especially of money.

The quantity of liquid assets held will increase with the uncertainty of the yield and costs expected; and, for a given return on total capital, the return from that part of it employed directly in production will have to be the greater the smaller the proportion which it forms of the whole. Investment will therefore be pushed less far, for this reason alone, in lines in which the investor's expectation of profit is uncertain or is more optimistic than that held by others. This, however, cannot be said to be necessarily a misallocation; provided we wish to continue to rely on the forces of automatic selection, it may be the best means of securing optimum long-run performance.

2. Price and output decisions. The second way in which the entrepreneur can reduce the risk of his business, and thereby contribute to economic stability, is by choosing his method of production, and the price and level of his output, so as to minimize possible fluctuations in profits.

It is important always to remember that the demand and cost schedules which we employ to illustrate the price and output decisions of the individual producer should relate to subjective and uncertain estimates of hypothetical magnitudes. Elementary demonstration of the equilibrium of the firm disposes of this crucial fact by assuming complete information. It is not possible, however, to make this model serve to represent the situation with imperfect knowledge merely by replacing the uncertain estimates by certain values equal to the mathematical expectation of the uncertain estimate discounted for risk. For the business man will take a course of action in the face of uncertainty which differs in kind from that appropriate to a situation in which expectations, whatever their value, are certain.

Thus there is no presumption that the entrepreneur will adjust his output so as to equate the expected values of marginal cost and marginal revenue; indeed, there are good reasons why he should not do so, but rather seek to produce on a smaller scale. Over-estimation of demand may prove more serious than under-estimation. This is so for three reasons. In the first place actual losses will in general exceed the difference between revenue and cost whenever the firm is forced to sell illiquid assets. Secondly, it is possible that the gradient of the short-run cost curve is

less for outputs which exceed that corresponding to minimum average cost than for outputs which fall below it. This would be the case where overheads were high and could not be reduced when output declined, whereas extensions could be added to the plant to enable a larger output to be produced at a cost which, though larger than that corresponding to full adaptation, was not excessively large. If demand exceeds expectations the entrepreneur will suffer an opportunity loss, through not having chosen initially a larger plant, the extent of which will depend on the difference between the levels of the short- and long-run cost curves for outputs above that corresponding to minimum average short-run cost. Similarly, if demand falls short of expectations there will be an opportunity loss depending on the difference between the short- and long-run average cost curves for outputs less than that expected. Thus if the short-run cost curve is of the shape that I have postulated, the opportunity loss which will follow from a demand which falls short of expectations will be greater than that which will be brought about by an unexpected high demand. A third and familiar final reason for inclining towards a safety-first policy is that losses are more disagreeable than gains are agreeable, provided the marginal utility of money diminishes with income.

Thus we might expect the business man to choose a scale of output less than that corresponding to the equality of the expected levels of marginal cost and marginal revenue, where expected profits, formally, would be maximized. By restricting output the difference between expected price and expected average cost could probably be increased, thereby widening the range within which demand and cost can deviate from expectations without causing a loss. Quite apart from restrictions imposed by increased risk and cost of borrowing, the output will therefore, if demand is at all elastic, be twice removed from the point where his expectations of price and marginal cost would be equal; the point which, if the expectations were regarded as correct, would be the formal optimum.

It would be proper to study under this head industrial combination, for there seems little doubt that in general it is resorted to, not in order to exact monopolistic revenue, but to reduce the hazards and uncertainties to which the participants are exposed. This they do by attempting to stabilize the receipts of the industry as a whole and, by diminishing combination within it, to stabilize the share of each producer in these receipts. But this is altogether too unwieldy a topic to incorporate here.

3. Grouping. The third and final method of reducing risk which I wish to consider is that of the grouping of ventures. It relies on the fact that the outcome of a group of uncertain ventures considered as a whole is more predictable than the individual component outcomes. Before discussing some of the important ways in which it differs from the forms of risk-

reduction so far considered, I wish to distinguish two different ways in which it may be carried out.

In the case of risks which are objectively estimated there is no special problem. Insurance companies do, of course, consolidate risks which are estimated in this way and their business can be regarded as the pooling of a large number of ventures in each of which there is a high probability of a small gain and a small probability of a large loss. Provided a sufficiently large number of instances can be grouped, the business in the aggregate can be made substantially free from risk. In some cases, owing to the difficulty of fitting the events into a homogeneous class of similar past events, the probability estimates may be very rough and the premia demanded correspondingly great. Nevertheless all but a few of the hazards which we regard as insurable have this in common: that estimates of their probability are made by demonstrable calculation, according to acknowledged rules from known evidence about the facts. The grouping of instances therefore presents no special difficulty; the individual estimates need not all be made in one mind, for, as they are formed according to fixed rules and require no special flair, one man's estimate is directly comparable with another's. There seems therefore no limit to the number of individual instances which can be grouped without impairment to the quality of the individual estimates.

With risks which are subjectively estimated the matter is otherwise. The ordinary investor will only be able to reduce his total risk by spreading his investments, provided the estimates he forms of each individual venture do not decline in reliability. This, however, is very likely to be the case, for if investors are to enlarge the number of ventures about which they have direct knowledge, then their knowledge of each is likely to be reduced. How, then, is risk-spreading successfully undertaken?

The ordinary investor will not usually attempt to form serious estimates of the probable success of particular projects, but will invest his money in a fair number of firms of established reputation. He will thus secure a diversified and comparatively riskless portfolio at the price of accepting a lower return on each individual investment. Reputation and goodwill are here an essential part of the mechanism. But it is important to realize that investment of this kind can only be practised so long as investment decisions of quite another kind are being taken at the same time. It presumes the existence of established firms for which the chances of success may be expected to outweigh the chances of failure, and such firms would never have been established, and would not continue to be successful, unless investment decisions were being taken which relied not primarily on the law of large numbers, but on foresight, on deliberately calculated estimates of the probable outcome of particular ventures.

The problem of grouping risky ventures, without impairment to the quality of the individual estimates of their outcomes, is therefore in the main merely transferred by the ordinary investor to the units to which they lend, and there, to some extent, it is solved. It is clear that almost all estimates of the profitability of a venture are partly based on the estimating capacities of others. An investor may be able himself to form estimates of the prospects in two lines; but if he knows someone whose foresight he esteems, then he can indirectly estimate the prospects in these ventures with which the latter person is directly familiar; this person can in turn know another, and so on, with the result that the original investor can form indirect estimates of the profitability of a good many lines. It would seem, however, that the reliance which he will place in an estimate will in general be the less, the larger the number of stages between it and the basic estimate. It is true, of course, that almost all our knowledge rests upon confidence in other people's estimates or reporting, but normally the liability to error in the estimate will be slight. When the scope for error is greater a much more intimate estimate must be made of the foresight of the person on whom we are relying, so that the existence of stable relationships of mutual confidence between a number of men seems to be a necessary condition for the successful grouping of subjectively estimated risks. Such a nexus of relationships is common throughout all society; its representative form in the economic sphere is the business corporation; when it is of a much looser form, between independent units, it is referred to as goodwill.

The large multi-product firm could therefore be regarded, from one point of view, as a system of relationships devised to enable the grouping of subjectively estimated risks. Although it is the most important, it is not the only organization performing this function. An industrial bank or an investment trust can also group risks. There are, of course, important differences: an investment trust cannot hope to have as close contact with the firms to which it lends as have the managing directors of a company with their subordinate officials, and it will either have to tolerate much less reliable estimates of each individual investment or, as is more likely, to confine its lending to firms which are established, or are engaged in less risky investment, or can offer good collateral. There are, of course, yet other differences which need not concern us here.

Grouping differs from the methods of risk reduction so far considered in two fundamental and interrelated respects: it does not produce any apparent misallocation of resources, and it precludes automatic selection. We observed above that the decisions which the entrepreneur is likely to take regarding the liquidity of his assets and the level and price of his output will produce an apparent misallocation, that is to say, an allocation

which is imperfect relative to the estimates on which it is based; but which, if it created an environment favourable to automatic selection, and thereby improved the quality of the estimates themselves, would be justified by the actual performance of the system in the long run. To the extent that risky ventures are grouped the need for such policies is the less, and likewise the apparent misallocation. At the same time, however, within the area of the grouping, the forces of automatic selection no longer operate; planned selection, as I have called it, intervenes. It is this latter form of selection which I now wish to discuss.

VI. Planned *versus* automatic selection

Planned selection may exist within units subject to automatic selection, or may characterize a whole economy. In such a situation control over resources does not vary automatically with the successful allocation of them, as a result of accruing profits and increased facility in borrowing. Within the sphere in which it operates, the firm or the economy, as it may be, planned selection is incompatible with the private ownership of the resources allocated. Automatic selection, on the other hand, normally presumes it, although it may exist where there is a degree of separation between ownership and control, as in the modern joint-stock company. Ideally under automatic selection the more efficient should not only prosper, but should, by virtue of their example, educate the others; in practice, however, this does not seem to work so well, for there often remain, for a considerable period, large differences between the efficiency of the various producers of a commodity. Under a planned system the level of entrepreneurial efficiency might be raised more rapidly by deliberate education. It should, of course, be possible in principle for the planned economy to reach a level of selection at least as efficient as the free economy, simply by copying the selective as well as the allocative mechanisms of perfect competition; but although this could be done, it need not, and certainly would no longer happen automatically. The planned economy, of which I take planned selection to be the most important mark, has, of course, its own defects. If the crucial problem of selection could be by-passed and all estimates of economic variables assumed to be equally reliable, then the planned economy would appear to give the better allocation. Provided the numbers of ventures was very large, the central authority could instruct its managers to follow the Rule according to their best estimates of price and marginal cost; for in this case gains and losses might be expected to cancel out and the outcome would in the aggregate conform to the mathematical expectation. It seems, therefore, on this very formal level, that the planned economy could, by pooling all ventures, enable more risky ones to be undertaken. For a private investor

will, as we have seen, discriminate against investments for which the standard deviation of the profit expectation is large, whereas the State manager need not.

But this formal analysis is far from decisive; it abstracts from any effect which the differing forms of organization might have on the psychological traits, such as adventurousness or timidity, of those who act within them. Moreover, in assuming that the estimates made by the managers of the planned economy could all be regarded as equally reliable, we assume away the crucial problem of selection. Perfect allocation on the basis of poor estimates may obviously be inferior, as judged by long-run performance, than imperfect allocation on the basis of better ones.

It would appear that the importance of automatic selection in our economy is declining. It has not, primarily, been deliberately rejected, on the grounds, right or wrong, of inefficiency, but the general climate of opinion and government policies informed by this opinion have indirectly created an environment inimical to its successful working. Taxation is perhaps the major influence at work in this direction. It acts both to inhibit entry by new enterprises and to enfeeble the selective forces at work between existing ones.

The redistribution of income has so reduced the flow of personal savings that, in the long run, the greater part of the funds available for new enterprises may have to come, directly or indirectly, from the government. That this has not already come about is perhaps due in part to transient and fortuitous factors; the conversion of the stock of the now nationalized industries into gilt-edged, and the purchase of gilt-edged by the banks, have indirectly released capital for new enterprises but cannot continue to do so indefinitely. Unless there is to be inflation, which would bias the investor in favour of shares as against fixed-interest stock, the government, if it is to prevent industrial stagnation induced by unfavourable terms of borrowing, would itself be obliged to provide funds for new enterprise. The effects on our economy of a movement towards government monopoly of new lending would, of course, be exceedingly far-reaching, and to speculate on them here would be quite outside my scope; but it seems clear enough that selection of the kind at work in the free economy would, for good or ill, almost have come to an end.

The selective forces between existing firms are at present also being sapped by inflation, and by the controls and high taxation which are its concomitant. Under inflation profits come to the efficient and the inefficient alike, and the forms of taxation by which the government recovers them often discriminate against the former class. Dividend controls, in a similar manner, will generally weaken the advantage in borrowing which the currently successful firm would otherwise enjoy.

These influences, quite apart from concentration in order to enjoy the economies of large scale or to reduce risk, may well, in the long run, render the survival of a system of automatic selection, in all but the minor sectors of our economy, very improbable. It is not impossible that economists themselves, in some slight measure, have contributed to its demise; for, neglecting the imperfection of our knowledge and the problems arising from it, they have, in their theoretical models, too often represented free competition as an allocative and not also a selective mechanism. This is understandable, for it is exceedingly difficult to lay down at all precisely the optimum conditions for selection, and it may be, as Mr. Little maintains, that 'such considerations, though in principle they ought to make the theory more realistic, would in practice only mean that we could reach no specific conclusions, because we would then be dealing formally with factors which are not in practice, nor even perhaps in principle, measurable'.

I am inclined to wonder, however, whether insistence on the need for the factors in our theory to be measurable in principle has not been overdone. It is in any case a concession to a philosophical point of view rather than to practical necessity, for what in economic theory is measurable in principle can rarely be measured in practice and has to be estimated by judgement or guess-work. Would it be too simple-minded to argue that, instead of building models which, while complying with our rigorous canons of verifiability in principle, fail lamentably to pattern the real world, it would be better, at least for some purposes, to construct theories or models which do satisfactorily explain the working of our economy, even when the relative magnitude or importance of the factors in them would have to be established by judgement rather than calculated from statistical observation?

It may be that the selective forces in the free economy were discussed much more when Darwinian theory was in the air, and probably the analogy between the working of the free economy and the operation of natural selection in the animal kingdom was pushed ludicrously far. Nowadays most people prefer mechanical to biological models, but whether they will prove the more fertile approach to the understanding of the economic system remains to be seen.

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THE ECONOMICS OF THE SCHUMAN PLAN[1]

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I. Introduction

THE economic purpose of the European Coal and Steel Community (the official name of the Schuman Plan) is to concentrate production of coal and steel in the most efficient units and to co-ordinate the operation and development of these industries so as to ensure that resources are not wasted by inefficient producers. To achieve this purpose a common market for coal, coke, iron ores, scrap, iron, and steel products is ultimately to be established by the sweeping away of all trade barriers and discriminations inside the Community. The market is to be competitive: freedom of entry and equality of treatment are to be instituted and preserved and any monopolistic domination prevented. The Scheme provides for the establishment of the High Authority—an expert administrative body—and of the Council of Ministers empowered to decide policy and to give general directions to the High Authority. The participating countries are France, Western Germany, Belgium, Holland, Luxembourg, and Italy.[2]

The aim of this paper is to consider how far and in what ways the unification of the market for coal, iron, and steel can lead to improvements in the economic organization of these industries and so to a cheapening of their products. This is the most important economic issue raised by the Plan, and the subsequent discussion will be concerned, almost exclusively, with its various aspects. The first three sections will deal with the structural reorganization of the coal industries which the Plan will eventually involve; the principles on which this reorganization should be based, its magnitude, and its economic effects will be examined in turn. The two sections then following will discuss respectively ways and means of improving the pattern of supplies of steel-making materials, and the problems raised by a greater specialization of steel plants.

II. Coal—Demand and Supply Conditions

1. Demand. Ever since the end of the war the demand for coal in the Schuman Community has exceeded its supply; it is probable that even

[1] The writer is indebted to Dr. A. M. de Neuman for his generous advice and criticism, and to his colleague, Mr. Richard H. C. King, for his kind help in the polishing up of the final draft of this paper.

[2] Since this paper is concerned with broad and general aspects of the Plan and not with the detailed provisions of the Scheme it has been judged unnecessary to give a formal summary of the treaty establishing the Community. The official text may be found in *La Documentation Française*, No. 1489, 1951, and an admirable summary in *The Economist*, 26 May 1951, p. 1236. The Scheme formally came into being in August 1952. All restrictions on trade in coal, iron ore, and scrap were abolished on 10 February 1953.

with emergency imports from the U.S.A. the requirements of some consumers, particularly in France, have not been fully satisfied. In 1952 the shortage was definitely less acute than in former years, but it is important to note that this improvement was only in part caused by the expansion of the coal output; more important was the fall in consumption due to the unexpected slowing down of industrial production and to the exceptionally mild winter of 1951–2. It is impossible to say when the shortage of coal will be genuinely overcome. The most optimistic forecast, made in June 1952 by the Coal Committee of the O.E.E.C., envisaged the possibility of attaining independence of emergency coal supplies by the end of 1953; but other forecasts made by the same body have mentioned much later dates.

The significance of the coal shortage for the problem of reorganization lies in the fact that, in all cases in which the closing down of inefficient mines must precede the expansion of low-cost collieries, the reorganization may temporarily make the shortage more acute. No doubt the eventual advantages may sometimes be worth the sacrifice, but generally inefficient capacity can only be scrapped at a rate commensurate with the ability of low-cost mines to expand their output in excess of the normal rate of expansion needed to satisfy the steadily growing current requirements. Thus, it seems that the elimination of inefficient capacity on a large scale cannot be begun before 1954 at the earliest.

2. Productivity. Wide differences in productivity mark the supply conditions in the coal industries of the three countries mainly concerned,[1] and are reflected in different costs and different pithead prices.[2] Table I illustrates these variations, but it is important to note that this table is defective in two respects. In the first place the figures are not up to date; regrettable as this is, it does not invalidate the very general conclusions based upon these figures—such information as is available suggests that the changes in output per man-shift which have taken place since 1949, while improving the position of France and Belgium (especially the position of their best districts) relatively to Germany, have not been great enough to alter the fundamental relations. The second, and more important, defect lies in the fact that the differences in average costs may give an exaggerated impression of the magnitude of the reorganization required. Unfortunately marginal cost data, which would be more relevant, are not available. Such as it is, the table gives some indication of the direction of the reorganization of the coal industry. The Ruhr is obviously

[1] i.e. Germany, France, and Belgium; the supply problems will be analysed with reference to these three countries only. Luxembourg does not produce coal, Italy produces too little to raise significant issues, and Holland is in the special position of a very efficient producer with very limited possibilities of expansion.

[2] The differences in prices also reflect the influence of factors other than productivity; these will be dealt with later.

the district[1] in which the bulk of the expansion must materialize, even though Lorraine, Blanzy, Saar, and Campine may make important contributions. On the other hand, it appears that some of the existing capacity in the districts of Cévennes, Dauphiné, Auvergne, and Nord[2] in France and in all districts except Campine in Belgium is likely to be uneconomic; when conditions permit, that capacity will have to be scrapped.

TABLE I

Comparative Efficiency and Costs in German, French, and Belgian Mines, 1949

	Output (mill. tons)	*O.M.S.* (overall) (tons)*	*Labour costs ($/ton)*	*Total operating costs† ($/ton)*	*Estimated pithead price† ($/ton)*
Belgium	27·8	0·64	9·13	13·97	14·63
Mons	4·6	0·61	9·84	15·06	15·78
Centre	3·7	0·65	8·95	13·69	14·35
Charleroi	7·0	0·64	8·95	13·69	14·35
Liége	4·5	0·55	10·96	16·80	17·61
Campine	8·0	0·75	7·60	11·63	12·19
France‡	65·6	0·72	6·13	8·22	9·37
Nord	27·7	0·64	6·88	8·74	9·95
Lorraine	9·8	0·96	5·21	6·62	7·54
Blanzy	2·6	0·87	5·06	6·43	7·33
Loire	3·8	0·73	5·60	7·11	8·10
Auvergne	1·2	0·67	6·72	8·53	9·74
Cévennes	2·9	0·59	7·76	9·85	11·23
Aquitaine	2·0	0·72	6·31	8·01	9·14
Dauphiné	0·5	0·60	8·15	10·35	11·80
Saar	14·2	0·85	5·27	8·48	9·50
W. Germany	103·2	1·03	3·76	6·66	7·19

Notes: * Output per man-shift. † Approximate. ‡ Adjusted for the inclusion of the Saar.
Source: E.C.E., *Economic Bulletin for Europe*, vol. ii, No. 2, p. 27.

3. Changes in productivity and costs. The general statement in the preceding paragraph must now be reviewed in relation to the possibility of expanding the Ruhr output, the possible changes in costs, and the effects of shifts from the local sources of supply to the Ruhr on coal users in France and Belgium.

Great reserves of coal suitable for efficient exploitation exist in the Ruhr. The immediate problem, however, is primarily that of expanding

[1] Efficient mines worthy of expansion may be found in the low-productivity districts, but generally the problem of reorganization may be considered in terms of districts and not particular mines.

[2] The name Nord will be used throughout this paper meaning Nord *and* Pas-de-Calais.

the output of existing mines. The rebuilding of the labour force and extensive repairs to war-damaged and war-neglected mines—in progress ever since 1946—have brought about a steady recovery in the total output; the O.E.E.C. estimates of June 1952 put it at 124 million tons in 1952, which is slightly above the pre-war level. The recovery in the efficiency of the Ruhr mines has also been steady and gratifying, but the O.M.S. 1·12 tons in March 1952 was still a long way from its pre-war figure of 1·6 tons. The existence of this discrepancy suggests that there is still room for improvement here. Expansion can be achieved by means of an increase in the labour force, or by that of greater mechanization, or by a combination of these two methods. The reaction of average costs thus depends on three factors: changes in wages due to the increase in the demand for labour, changes in productivity, and changes in the average capital costs. Labour costs account for over 50 per cent. of the total costs of coal production in the Ruhr, and the increases in O.M.S. achieved by greater mechanization may tend to reduce labour costs significantly enough to provide a margin out of which increases in other costs can be met. Moreover, the progress of mechanization may reduce, or limit the increase in, the labour requirements, thus counteracting the tendency of stronger demand to cause wage advances. If it is correct to take the discrepancy between the pre-war and the 1952 levels of O.M.S. as indicating the scope for increasing productivity, it appears reasonable to expect that expansion will not make costs rise significantly.

There is no doubt that opportunities for improvements in efficiency exist in both France and Belgium.[1] The mechanization of mining and of the underground transport has lately made good progress in the district of the Nord, but the task is by no means finished. Natural conditions in the Nord are much more difficult than in the Ruhr and so the latter is likely to remain more efficient than the former; even so, a narrowing of the gap as compared with 1949, or even 1952, is possible and likely to prove economical. In Belgium, as in France, considerable improvements in efficiency can economically be achieved. The official plans submitted to and approved by the O.E.E.C. envisage great advances in the mechanization of mining, a thorough reorganization of the underground transport, and various improvements in surface arrangements for the handling of coal.

[1] The progress recorded between 1949 and March 1952—E.C.E., *Bulletin of Coal Statistics*, Sept. 1952—is impressive. In France the average O.M.S. rose from 0·72 ton to 0·88 ton (22 per cent.); so far as can be ascertained, the greatest advance took place in Lorraine, which is a new and expanding, very efficient, district; the improvement in the district of the Nord—most important from the standpoint of the reorganization—was, probably, below the average. In Belgium the rise in O.M.S. was from 0·64 ton to 0·75 ton (17 per cent.)—the improvement being greatly above the average in the new district of Campine and considerably below the average in the other districts, particularly in the districts of Mons and Liége.

This technical reorganization is expected to raise the productivity of workers at the coal face and to reduce the ratio of non-face to face workers, thus raising the overall O.M.S. still higher. It should be noted that even in the newest and best district of Campine there is much room for improvement; for example, the O.M.S. of 1·52 tons in the district of Limburg (Holland), which belongs to the same geological formation, is 60 per cent. higher than the O.M.S. in Campine (March 1952). The Belgian coal industry is faced with the problem of unusually high 'other operating costs'—roof supports, stores, materials, fuel, &c., but this problem cannot be analysed in detail because the relevant information is not available. Generally speaking the concentration of production in a smaller number of mines of superior efficiency may reduce requirements for stores, materials, fuel and power, and so on, and when an allowance has been made for this and for other possible economies, a reduction in 'other operating costs' of about 20–25 per cent.—which would still leave these costs higher than in Germany and very much higher than in France—does not seem impossible.

4. Transport costs and delivered prices. The policy of making the French and Belgian consumers divert part of their demand from their local coal-suppliers to the Ruhr is sound only if Ruhr coal can be *delivered* to them at a lower price than French or Belgian coal. Allowance must therefore be made for the costs of transport, but the figures for freight rates are unsatisfactory for this purpose because they are highly discriminatory and do not reflect the *costs* of transport. In the absence of information on actual costs of transport it is necessary to rely on the very general proposition that these costs tend to vary in proportion to distance. The distance between the industrial centres of Lorraine, Nancy, and Ardennes and the Nord is roughly the same as their distance from the Ruhr, and so the costs of transport may be taken as equal in the two cases—probably $3 per ton, the actual freight rate from the Nord to Lorraine, is approximately the true transport cost.[1] In the absence of discrimination the delivered price of Ruhr coal would be lower in Lorraine than the price of Nord coal. Other industrial districts in eastern and central France—those located around the steel-producing centres of Creusot, St. Étienne, and Montlouçon—are situated at or near the coal-producing areas of Blanzy, Cévennes, and Auvergne respectively. Even so, they consume considerable quantities of Nord coal because the local outputs are insufficient in quantity and indifferent in quality; in particular local coal is not suitable for coking, and so all coke or coking coal must be imported. The difference in the true cost of transport between these districts and the Nord on the one hand and the Ruhr on the other probably slightly favours the former; it is, however, small and definitely inadequate

[1] E.C.E., *Economic Bulletin for Europe*, vol. ii, No. 2, p. 40.

to offset the pithead-price difference favouring the Ruhr;[1] again, there is a case for a shift from local sources of supply to the Ruhr. Similarly, Ruhr coal is likely to be cheaper than Nord coal to consumers in south-west France (St. Nazaire, Bordeaux), but the position is reversed in respect of the north-west (Normandy), the Paris region, and the area north of the river Seine.

Thus the figures for costs and prices in the first half of 1950 lend strong support to the case for contracting the mining capacity in operation in the district of the Nord, at least to the extent of its 'exports' to the industrial districts mentioned in the preceding paragraph, and in some other French coal-mining districts (Cévennes, Dauphiné) with a simultaneous expansion of the imports of Ruhr coal. Between 1950 and 1952 French coal prices rose more than German coal prices; this development strengthens the above conclusion.

The arguments in the preceding paragraph apply with even greater force to the case of Belgium. The discrepancy between the Belgian and the German coal prices is pronounced: at mid-1952 the Belgian average pithead price was about 25 per cent. higher than the German. Moreover, since the distance between the Ruhr and the main industrial centres in Belgium is short, the considerations of the costs of transport do not alter the position. Thus, in 1952, if costs were decisive in this respect German coal would have been able easily to compete with Belgian coal in Belgium herself. It appears therefore that, if the German coal industry could supply—at present prices—the necessary quantities of coal, and if Belgian mining costs could not be reduced, a strong economic case would be established for scrapping a large part of the Belgian coal industry.

In concluding the discussion of cost and price relationships it is necessary to point out that the latter are, of course, sensitive to changes in general economic conditions and policies. Thus a relative strengthening of inflation in Germany would improve the position of the coal industries in France and Belgium *vis-à-vis* the German coal industry. A depreciation of the French and Belgian currencies would have the same effect. And vice versa. Between 1950 and March 1952 the progress of inflation (measured by the movements of the official index numbers of wholesale prices) was greatest in France (73 per cent.), much less pronounced in Germany (25 per cent.), and smallest in Belgium (16 per cent.). During the same period coal prices (average pithead quotations) rose by 54 per cent. in France, by 45 per cent. in Germany, and by only 5 per cent. in Belgium. The progress of inflation has worsened the position of France in relation to Germany and improved that of Belgium in relation to Germany.

[1] This comparison is based on average pithead prices and may therefore be inapplicable to certain grades of coal, or to coal produced by efficient mines in the high-cost areas.

III. Reorganization of Coal Industries

1. General principles. The aim of reorganization is to eliminate inefficient mines. That is to say, collieries which cannot withstand the competition of other collieries at the places where their coal is consumed must disappear and every colliery must eventually be able to pay its way.[1] Only the mechanism of a free and competitive market can perform this task of selection—which is the essence of reorganization—and it is only after the price mechanism has been in operation for some time that a precise picture of reorganization will emerge. To estimate it in advance we should require: (*a*) a complete set of notional supply prices,[2] (*b*) information about the cost structures of the mines to which the 'survival test' is to be applied. A comparison of the actual and notional supply prices shows whether or not the mine in question qualifies for survival. The writer feels bound to emphasize that his estimates of costs, the summary of which was given in the preceding section, and those of the notional supply prices, which follow, are highly tentative; moreover, costs are average and not marginal costs. Even so, he believes that it is worth while to form a general idea of the magnitude of the upheaval which is likely to result from the implementation of the Schuman Plan. What follows is thus only a rough and ready estimate of the extent of inefficient capacity in France and Belgium, submitted to indicate its order of magnitude.

It is clear from the definition of the notional supply price that there should be one for every mine. But it would be futile to attempt such a differentiation here and so, for the purposes of the subsequent analysis, only two average notional supply prices are taken: one for the district of the Nord, and one for Belgium. On the basis of the structure of pithead prices and transport costs in the first half of 1950, the former could be put at $10 per ton and the latter at $9.50 per ton. Owing to the increases in costs, it is now (second half of 1952) necessary to put them at higher figures—probably at $13 and $12 respectively.

2. France. The really important case is that of the Nord. Up-to-date information concerning the efficiency of individual mines in that district is not available and, in its absence, it is necessary to rely on 1947 figures[3] corrected for the changes which occurred between that time and the beginning of 1950. This correction assumes that the increase in efficiency recorded for the whole district can be uniformly applied to all mines in that area. This method is admittedly crude, but it appears the only one

[1] This follows from the provision of the Schuman Treaty that all subsidies are, in due course, to be abolished.

[2] The notional supply price of a given mine is its maximum pithead price which enables it to hold its market against the competition of the best-placed alternative supplier when the latter's output is expanded sufficiently to meet the requirements of the former's market.

[3] *Statistique de l'Industrie Minérale*, 1948, fasc. 1.

possible. In the circumstances of the first half of 1950, but allowing for the then probable increases in efficiency, the estimate of the inefficient capacity could be put at 20–25 per cent. of the total capacity of the district at work at the end of 1949—5·5–6·5 million tons in terms of 1949 output. Between 1950 and mid-1952 the costs of production rose more in France than in Germany. It therefore appears necessary to allow for inefficient capacity in the Nord to an extent somewhat greater than estimated above.

Apart from the Nord the reorganization of the French coal-mining industry appears to require a substantial measure of scrapping in the districts of Cévennes, Dauphiné, and Auvergne. This conclusion is based on the conditions of the first half of 1950, but there is nothing to suggest that the efficiency of coal-mining in these districts has improved since that time relatively to the efficiency of the Ruhr. At any rate they are small centres: in 1949 they produced 2·9 million tons, 0·5 million tons, and 1·2 million tons respectively. Once the general coal shortage is over, even their complete disappearance would not create significant supply problems.

It follows that, when the efficient producers expand their output sufficiently to be able to satisfy all demands for coal, a significant proportion of the French mining capacity will have to be scrapped as inefficient. On the original data[1] the reorganization appears to involve capacity which produced about 10 million tons in 1949, but in view of the trends which came to light between 1950 and 1952 this figure is likely to prove an underestimate.

3. Belgium. As in the case of France, the following estimate is based on old (December 1948) data[2] approximately adjusted to show the situation at the beginning of 1950. In addition, it is assumed that a 25 per cent. increase in efficiency will be achieved during the period of transition (rather less than 5 per cent. a year for 5 years). This increase is assumed to apply to every mine which was in operation in December 1948; the mines whose supply prices are not thereby brought to or below the notional level are considered unfit for survival. On the basis of the cost relationships of the first half of 1950 these calculations suggest that, in terms of 1949 output, the capacity responsible for about 12 million tons of coal (about 40 per cent.) would have to be scrapped. If, however, a 20–25 per cent. reduction in 'other operating costs' is considered probable—and this seems reasonable—the estimate of unfit capacity may be reduced to about 6 million tons—20 per cent. The Liége, Mons, and Charleroi districts will in either case bear the bulk of the burden.

[1] 1949/50 figures. These were the most recent figures available at the time of the Schuman Plan negotiations (June 1950–March 1951).

[2] *Annales des Mines de Belgique*, March 1949.

In 1951 and 1952 the position of the Belgian coal industry improved in relation to Germany. In consequence, on the basis of the conditions prevailing in the middle of 1952, it appears that the reorganization of the coal industry in Belgium may be less far-reaching. But the difference is probably small.

On the other hand, recent pronouncements by Belgian industrialists,[1] and the absence of improvements in the efficiency of mining in the three districts mainly concerned, suggest that the assumptions on which the above estimate of the magnitude of the reorganization has been calculated may err on the side of optimism. The increase in O.M.S. in the districts of Mons and Liége between 1950 and June 1952 failed to reach the assumed rate of 5 per cent. per year. Mining reorganization schemes often take a long time to bear fruit—the inadequacy of the performance up to June 1952 should not therefore be taken as conclusive evidence that the required increase is unattainable. But it does indicate that the obstacles to the improvements in efficiency are greater than expected and that consequently the ultimate increase may be smaller than postulated. If this in fact is the case the estimate of the inefficient capacity must be appropriately raised. Moreover, even on the basis of the elimination of productive capacity of the order of 6 million tons, fears have been expressed that serious problems of unemployment may arise and that in times of coal shortage the Belgian economy may become dependent on the goodwill of Germany.[2]

IV. The Effects of Reorganization of the Coal Industries

1. Saving of man-power and capital. The concentration of production in the most efficient units will reduce the total labour requirements of the coal industries in the three countries. The reorganization envisaged in the preceding section may be expected to release about 30,000 workers in Belgium (almost half in the district of Liége) and about 50,000 in France (nearly 40,000 in Nord alone). The shortage of mining labour which has of late been experienced in most coalfields in Belgium and in the district of the Nord in France will thus be significantly eased.

The position in the Ruhr appears different. With increasing efficiency output may be expanded without any great increase in the number of workers and so, if the efficiency of the mines in the Ruhr approaches its pre-war level, that region may stand in need of very few new miners. It should be noted that in 1937 the Ruhr, with 30,000 fewer miners, produced 20 million tons of coal more than in 1949. On the other hand, if the

[1] Cf. M. Martens, *Annales des Mines de Belgique*, 1951.

[2] M. Meeus, *Études Économiques* (published by the University of Mons), Nov. 1951; also other writers in the same issue.

demand for miners in the Ruhr exceeds their supply the release of labour from French and Belgian mines is unlikely to help in the solution of this difficulty because of the immobility of labour. It is true that the Schuman Treaty foreshadows far-reaching relaxations of migration restrictions and that various inducements to move can certainly be devised, but it must be borne in mind that the mobility of miners has always been notoriously low. The fact that the proportion of foreign workers in the Nord and in Belgium is high may somewhat ease the situation in this respect; foreign workers, particularly new-comers, are likely to be more mobile than native miners. Many of the foreign workers, however, may, for various reasons, be extremely reluctant to move to the Ruhr.

The labour requirements of the other expanding districts—Lorraine in France and Campine in Belgium—tend to grow because new pits are being sunk and developed. If the miners from the contracting areas would move into these districts an important obstacle to the expansion of their outputs would be removed. But the mobility of miners, though greater than in the case of movements to the Ruhr, is nevertheless likely to be small (except perhaps among the foreign workers), and this makes it difficult to be optimistic on this score. The conclusion to which this discussion appears to lead is that, while reducing the total labour requirements of the coal industry, the reorganization is unlikely greatly to ease the labour supply problems of the expanding districts.

The closing down of inefficient collieries will cause some labour redundancy and will therefore create the problem of re-employment. The estimates of the prospective redundancy of miners given at the beginning of this section need not cause alarm. Considered[1] in relation to the total working population the figures quoted are very small, and if, in view of the low mobility of miners, it is thought that the relation of the prospective redundancy to mining employment only—which appears substantial—is more relevant, it is important to notice the existence of several important alleviating factors. In the first place, the process will be spread over a period of, probably, considerable length—perhaps 4–5 years. Natural wastage will in the meantime create vacancies for at least some of the dismissed workers. It may also be noted that in France mining employment figures indicate a mild but consistent downward trend showing that natural wastage is not being made good. Secondly, even if every effort is made to secure that the expanding mines increase output by means of raising their efficiency (O.M.S.), some increase in their labour force will

[1] To illustrate: in Belgium the estimated redundancy would account for about 25 per cent. of miners at work in June 1952 but for only 1·5 per cent. of the total working population; in France these proportions are 20 per cent. and 0·3 per cent. respectively. The probable concentration of redundancy in particular districts makes the problem more difficult, but it should be borne in mind that several alleviating factors may be present.

certainly be required; some dismissed workers will be locally re-employed. Thirdly, given a high level of employment the resettlement of inter-industrially mobile miners in other industries should not be difficult. Nord and Liége, where the bulk of redundancy cases will arise, are large and diversified industrial centres offering many and various employment opportunities. Moreover, the High Authority will initiate and finance retraining and resettlement schemes designed to facilitate the re-employment of dismissed miners in other industries.

The concentration of investment in more efficient mines and areas will naturally make possible certain economies in the use of capital. At the same time the supply of capital to the coal industry may be expected to increase. Special compensation funds are to be accumulated by the High Authority from levies on coal and steel output and government contributions; these funds will be used for investment purposes. The High Authority will also be entitled to borrow money and, as its standing will be better than that of individual mining concerns, it will find it easier to raise funds; these funds will be re-lent to particular firms. The guarantees of the High Authority will improve the standing of the firms enjoying them, thus making it easier for them to raise capital. Finally, the improvement in the security of investments, due to the co-ordination of plans by the High Authority, and the more extensive information concerning the chances and prospects of particular ventures, made available by the publication of the High Authority's opinions on these projects, will increase the attractiveness of investment in coal-mining.

Smaller capital requirements, together with a greater supply of capital, will tend to make it cheaper. The coal industry will gain by finding it easier to finance its investments. Whether or not this development can be said to be beneficial from the point of view of the utilization of scarce resources in general depends upon whether the marginal efficiency of capital in the coal industry is or is not higher than in other industries. The most that can be said is that the priority given by all national plans to investments in the coal industry suggests that the marginal efficiency of capital in that industry is believed to be higher than in most other fields.

2. Pithead price adjustments and their effects. The effects of the Schuman Plan on the French coal prices will, in the early years of the Scheme, depend on the arrangements made by the High Authority for the accumulation and use of the compensation and equalization funds. These arrangements will probably tend to lower the level of coal prices, but no spectacular reductions can be expected. It is only when a substantial measure of high-cost capacity is eliminated that prices will tend to fall to the level dictated by the costs of efficient producers. The effects of the

price adjustments will thus, generally speaking, benefit the French consumers of coal.

In Germany, on the other hand, the Scheme will probably cause a general increase in coal prices charged in domestic transactions. This may be expected partly because of the abolition of dual pricing,[1] which has hitherto had the effect of making exports subsidize home prices of coal, and partly because of the proposed imposition by the High Authority of special levies. So long as the coal shortage persists the extent of the price adjustments will depend on the principles and methods of price control used by the High Authority. Generally speaking, it appears that the Schuman Plan will, in its immediate effect, impose a certain burden on German coal consumers; but this burden is likely to be only temporary.

Belgium is a high-cost producer of coal, and so the Scheme should be expected to make for a fall in Belgian coal prices. In estimating the effects of the price changes the problem of subsidies must be taken into account. Ever since the end of the war Belgian coal has been subsidized—the burden being borne partly by the government and partly by the efficient units of the industry. The subsidization is to continue during the transitional period, part of the cost being borne by the High Authority and part by the Belgian Government. Under the new scheme the subsidy per ton is likely to be higher than it has been hitherto; coal prices will fall, but the decrease is unlikely to be great. Apart from the general subsidy scheme, additional subsidies may be granted to reduce the prices of coal and coke sold to the iron and steel industry to the level of prices paid for these materials by the iron and steel industries of other member countries. The details of these subsidy schemes have not yet been published and so no estimate of their effects can be made.

A genuine fall in Belgian coal prices (i.e. a fall not due to subsidies) can only appear when a substantial measure of reorganization has been successfully carried out, that is to say, when the high-cost capacity has been eliminated and any deficiency of supply made good by the imports of cheap German coal. It should be noted that the availability of cheap German coal is of crucial importance; so long as it is not available the elimination of high-cost mines—which is the precondition of the genuine reduction in coal prices—cannot be carried out.

The economy of Luxembourg will also benefit substantially. The iron and steel industry is the chief industry in the Principality and the reduction in Belgian coal (and coke) prices will be of considerable help to it. In so far as Luxembourg users are supplied by the Ruhr they will also benefit, because the abolition of the dual pricing will more than offset the possible increase in the German pithead prices. The information on which a

[1] Cf. below, sub-section 3, p. 170.

detailed analysis of these benefits could be based is lacking—coal consumption in Luxembourg is included in Belgian statistics.

The effects of the changes in pithead prices on the Dutch economy will be similar to those described in the case of Germany; published information is, however, insufficient to permit an estimate of their magnitude. Nothing can be said about the position of Italy: she depends too much on coal imported from outside the Community to feel directly any important effects of price adjustments limited to the countries within this group.

3. Dual pricing and freight discrimination. Dual pricing is very widespread in international trade in coal, but for the present purpose the case of German coal is the only one of importance. Under this system the price of the German coal sold in France, Belgium, and Holland is so fixed by the German selling agency as to be just below the price of American coal at the place of consumption. The surcharges vary inversely with differences in transport costs: for example, in 1950 coal sent to France by rail bore a surcharge of $1 per ton, whereas coal sent by water bore a surcharge of $2; the price paid by Belgian and Dutch buyers included a surcharge of about $4 per ton. The effect of this practice is to increase the cost of coal in the importing countries; equalization funds and price control are used to spread the difference evenly over all consumers of coal.

By making the alternative supplies of coal more expensive dual pricing may raise the profitability of certain mines in the importing countries. Thus some high-cost collieries which would normally be closed down may for a time remain in full operation making a contribution to the total output. In this sense it may indeed be said that dual pricing can cause the total coal output to be greater than would otherwise be the case. But the importance of this point is small. The argument is formally valid *only* under the conditions of *acute* shortage of coal—otherwise, to practise dual pricing the low-cost mines would have to restrict their output; moreover, even then, its applicability is limited to special cases unlikely to be numerous. If the problem is looked at from a more long-run point of view it is clear that dual pricing prevents the concentration of output in the cheapest sources of supply. It encourages the importing countries to develop mines which are bound *at all times* to be more expensive coal producers than the mines of the Ruhr; and this development of mining capacity in the importing countries is very likely to make the German coal industry very cautious in its expansion plans lest it should, in a few years' time, have a large productive capacity and face restricted markets for its products.

The writer believes that the solution of the conflicting requirements of the present moment and of the long-run aims should be sought on the basis of the international allocation of scarce supplies of coal, perhaps combined

with agreed schemes of subsidies to mines which must *for the time being* be kept in operation and which would be closed down in the absence of outside assistance. On the other hand, prices should be fixed at the estimated market equilibrium level. This would encourage low-cost mines to expand, while the temporary character of subsidies would induce high-cost collieries to improve their efficiency, if possible, or gradually to close down. The directing bodies of the Schuman Community are given adequate powers to be able to solve these problems.

Secondly, the overcharging of foreign consumers makes possible—because of the existence of the central selling agency—sales of coal to domestic consumers at prices somewhat lower than would be the case in the absence of discrimination. The difference is probably small, but even so it may be significant in the case of industries whose fuel costs are high relatively to total costs. Through dual pricing foreign consumers of German coal subsidize German coal users—their competitors in many international markets.

Thirdly, every discrimination against foreign buyers is likely to cause resentment among them, thus leading to international friction and ill feeling; it may create a desire to retaliate, and this may tend to perpetuate the economic dislocations due in the first instance to the original discriminatory treatment.[1]

The elimination of dual pricing in the Schuman Community will thus have important economic effects bearing on the pattern of the development of the coal industries and on the cost structures of many important industries. It may also have certain beneficial political effects.

The problem of discriminatory railway freights arises primarily in connexion with the Franco-German coal trade. The distance from the Ruhr to Lorraine is the same as from the Nord to Lorraine, and yet the freight rate is only $3 in the latter case whereas it is $5 in the former. In spite of the rough equality of distance, some difference in freight rates is, of course, possible owing to differences in the structure and costing of the two railway systems. But there is no doubt that the chief reason for the existing disparity is to be found in deliberate French discrimination against German coal. This policy was introduced in the inter-war period to counteract the natural advantages possessed by the Ruhr over the Nord in order to protect the French coal industry from German competition. With the shortage of coal this protection is unnecessary. The reason for the survival of the device of freight discrimination is the fact that were it abolished the price of the German coal exported to France would no doubt be increased by the German sellers. Thus in fact, though not formally, the French

[1] For more exhaustive treatment of this problem see 'Economic Aspects of Dual Pricing', by A. M. de Neuman and D. J. Morgan, *Cartel*, July 1951.

practice of freight discrimination may be considered a retaliatory measure designed to reduce the opportunities for German dual pricing. At any rate a simultaneous abandonment of the two discriminatory practices—the two Governments have pledged themselves to abandon them by signing the Schuman Treaty—will be of great benefit to French consumers of Ruhr coal: it will at the same time stimulate and speed up the rationalization of the coal industry in the district of the Nord.

4. Abolition of obstacles to trade. This problem must be considered in a somewhat unorthodox manner. Coal and coke are not, at present, subject to customs duties and fixed quotas; even so, trade in coal is by no means free: the business is transacted by central exporting and importing agencies whose policies, especially price policies, are often influenced by non-economic motives and factors. In time of acute shortage control is unavoidable, and, so long as the coal shortage continues, the Council of Ministers and/or the High Authority will direct the distribution of supplies. The superiority of the High Authority over national controlling agencies lies in the fact that it will—it is hoped—allocate coal on the basis of the relative urgency of needs without regard to the nationality of users.[1]

As soon as supply catches up with demand these special arrangements will be abandoned. This will cause demand to shift to the cheapest sources of supply. The significance of the abolition of obstacles to trade *within the framework of the Schuman Plan* will, however, be more far-reaching. Within this framework it will have a much greater chance than would otherwise be likely of being looked upon as a permanent state of affairs. And it is only if the unification of the market is considered permanent that the structure of production will be adjusted to the requirements of demand in the *common* market. More specifically, the Germans can only be expected to expand the Ruhr output sufficiently to meet the needs of their French and Belgian customers if they are absolutely certain that these markets will be permanently open to them. Conversely, the French and the Belgians can only be expected to agree deliberately not to expand, or even to reduce, their own mining capacity if the availability of German coal at reasonable prices is guaranteed to them even in time of universal shortage. A mere clause in a treaty abolishing tariffs, discriminatory freight-rates, &c., would not be an adequate guarantee. But a scheme such as the Schuman Plan, providing for co-ordinated development of the coal industries, will gradually create conditions making the return to nationalistic policies difficult and upsetting. The realization of this fact may be expected to stimulate confidence in the permanence of market unification.

[1] This appears to provide an answer to the complaint of the Belgian industry that it will become dependent on the goodwill of the German coal sellers; in time of shortage the High Authority will have powers to override the wishes and preferences of coal suppliers.

The more general problem of equality of treatment may also be dealt with under the heading of the removal of obstacles to trade. In a single and competitive market all buyers must be treated equally. In this connexion great difficulties were at one time reported to have arisen during the negotiations of the Schuman Treaty over the problem of the vertical integration of the German steel industry which gives it control over the production and sale of metallurgical coke. Obviously this arrangement, were it allowed to continue in existence, would put the German steel industry in a particularly favourable position in respect of both the price and the security of coke supplies. Since France is greatly interested in the supplies of Ruhr coke it was only natural that the French delegates should have pressed this point, eventually securing its acceptance. The High Authority will be entrusted with the supervision of the industry to secure that, once 'decartelized', the Ruhr coal and steel industries do not again integrate to the extent which would tend to ensure a special position for some customers. Only a complete abolition of obstacles to competitive trading—public and private, formal and informal—can be really permanent; and only the permanent abolition of obstacles can secure the development of the industry on the basis of a common and competitive market.

V. The Reorganization of Supplies of Steel-making Materials

The purpose of this section is to show what improvements in the organization of supplies of the three basic steel-making materials—coke, iron ore, and scrap—will become possible thanks to the unification of the market, and to estimate the effects of these improvements on pig-iron production costs. The discussion will be confined to the main pig-iron producing countries: Western Germany, France, the Saar, Belgium, and Luxembourg. A short note on the position of Holland and Italy will be added at the end of this section. The problem will be examined first on the basis of the conditions prevailing in the first half of 1950—this is of some interest because it is in this light that the problem must have appeared to the authors of the Schuman Plan at the time they were shaping it; such information about the conditions in 1952 as is available will then be used to make the analysis more up to date.

1. Coke. The countries of the Schuman Community possess substantial reserves of coal suitable for coking. The largest reserves lie in the Ruhr, but fairly good coke is also produced in France (Nord), Saar, Belgium (Campine), and Holland (Limburg).

Although the coke situation cannot yet be described as easy, the expansion of coke output since 1949 has been large enough to dispose of most difficulties. In that year the countries of the Community produced 44

million tons of metallurgical coke; in the first quarter of 1952 the coke output was running at the annual rate of 57 million tons;[1] it may be added that the output of coking coal continues to increase, and the coke-oven capacity is being expanded. The increase in production enabled the coke suppliers to step up deliveries to blast furnaces from 25 million tons in 1949 to the annual rate of 35 million tons in the first quarter of 1952. On the basis of the targets set for pig-iron production for 1953 this quantity appears adequate to meet the requirements of the blast furnaces. With further expansion a reorganization of supplies will therefore become possible: the buyers of coke will be able to purchase it from those sources of supply whose prices at the coke-ovens and the relevant transport costs enable them to deliver coke at the lowest inclusive prices—with due allowance, of course, for differences in quality.

Although the figures given in sections B and C of Table II (below) are only tentative, the differences between the delivered prices of coke produced in various regions are in most cases sufficiently pronounced to provide grounds for general conclusions concerning the proper choice of coke suppliers for the coke-consuming (i.e. pig-iron producing) districts.

There is no doubt whatsoever that the pig-iron producers in Western Germany should obtain their coke supplies from the Ruhr. On the estimates based on 1950 conditions the Ruhr also seemed to be the cheapest supplier of coke to Luxembourg; on 1952 data, however, this appears no longer to be the case—on the contrary the estimated price relative favours Campine. But the difference is very small and so no definite conclusion can be arrived at.

In the first half of 1950 the German producers could deliver coke to Belgian buyers substantially cheaper than the Belgian suppliers. They did not do so because of the coke shortage. Since that time the difference between the Belgian and the German coke prices has considerably narrowed and the reorganization may further strengthen this tendency. Indeed, the figures in Table II suggest that the price difference in favour of Germany is likely to disappear altogether. In such a case Belgian coke producers would be the most economic suppliers to Belgian coke users. Moreover, from a broader point of view it may be reasonable not to carry out a reorganization involving the scrapping of the coke-oven capacity in Belgium even if there persists a *small* price difference in favour of Germany. Coke-ovens yield a number of by-products: gas, heat, certain bituminous substances, &c.; if the discontinuation of their domestic supply were to make these products more expensive, or if the costs of processes using coke-oven gas and heat were to rise, it would become economically sound to make the by-products bear a greater share of the costs of

[1] E.C.E., *Bulletin of Coal Statistics*, Sept. 1952.

TABLE II

Delivered Coke Prices (*$ per ton*)

Producing district and coke-oven price		*Consuming District*				
		Lorraine	*Luxem-bourg*	*Western Germany (av.)*	*Belgium (av.)*	*Saar*
A. First half of 1950—Actual prices*						
Ruhr	10.00	15.63†	15.85	10.71	..	..
Campine	15.10	..	15.50	..	15.90	..
Nord	13.44	16.47	..	..	..	..
Saar	13.65	..	..	..	..	13.65
B. Common Market—Hypothetical 1950 conditions						
Ruhr	10.00	12.00	11.72	10.71	12.00	13.00
Campine	11.70	13.70	13.50	..	12.50	..
Nord	13.05	16.11	..	..	..	..
Saar	13.65	14.97	..	..	..	13.65
C. Common Market—Hypothetical 1952 conditions						
Ruhr	14.85	16.85	16.78	15.56	16.85	17.85
Campine	14.75	16.75	16.55	..	15.56	..
Nord	16.75	19.75	..	..	..	..
Saar	19.40	19.73	..	..	..	19.40

Notes: The estimates in sections B and C have been arrived at as follows: the ratio of coke to coal prices has been assumed to be the same as in 1950; the coal prices are estimated actual prices for the Ruhr and the Saar and the notional prices for the Nord and Campine (cf. p. 163 above). The costs of transport have been estimated by means of adjusting the E.C.E. figures (*Economic Bulletin for Europe*, vol. ii, No. 2, pp. 30–33) for known cases of freight discrimination; the cost of transport between the Ruhr and Lorraine has been further adjusted on the assumption that regular return cargoes of iron ore are provided. The delivered prices are therefore only roughly approximate, but they are unlikely to have been underestimated.

* Average prices ruling during the first half of 1950; German export prices were above home market quotations; Belgian prices were subsidized (including the prices of coal and coke sold to Luxembourg). *Source*: E.C.E., *Economic Bulletin for Europe*, vol. ii, No. 2, pp. 30–32.

† In the source this figure is given as the average for France, it is here taken as directly applicable to Lorraine because no other district in France used German coke. It is the estimated true delivered price, *not* adjusted by the Caisse de Compensation.

carbonization. This would make possible a reduction in the price of coke itself. On balance it seems that the Belgian pig-iron producers should rely on domestic supplies of coke. This is a *general* conclusion: it may well be sound to close down certain ovens at once and not to replace some other ovens as they wear out.

The Saar is in a position similar to that of Belgium. At the prices of the first half of 1950, and given non-discriminatory pricing and transport charges, Ruhr coke could be delivered to blast furnaces in the Saar somewhat cheaper than the locally produced coke. It seems that the situation

has not altered since that time; but the by-product considerations,[1] the possibility of an increase in the price of Ruhr coke, and the possibility that the price of Saar coke given in section C of Table II has been somewhat overestimated, may justify the continuation of the present practice of basing the pig-iron production in the Saar on locally produced coke.

The present organization of coke supplies in France—relying heavily on Nord coke—is by no means the most economical. It is true that the blast furnaces in the Nord must, of course, continue to rely on Nord coke and that for the small pig-iron manufacturing centres—Caen, Alpes, and Ariège—the Nord (their present supplier) is probably the cheapest source of supply of coke. But the conclusion is entirely different in the case of Lorraine–Nancy (hereafter called Lorraine) pig-iron producing district; and this district accounts for four-fifths of the total pig-iron capacity in France.

In the first half of 1950, in spite of all discriminatory practices (German dual pricing and French freight discrimination) and without return cargoes, the true delivered price of Ruhr coke (i.e. its price not adjusted by the Caisse de Compensation) was about $15.63 per ton—$0.84 less than the price of Nord coke. In the absence of discrimination the price would have been about $12—which shows the true superiority of the Ruhr over the Nord as coke supplier to Lorraine. The unification of the market may, and probably will, reduce this superiority; even so, as Table II shows, the price of Ruhr coke delivered in Lorraine is likely to be considerably lower than the comparable price of Nord coke. Another advantage of using the former is its quality, which is definitely superior to that of the latter.

In 1950 the Saar, as a supplier of coke to Lorraine, stood in a middle position between the Ruhr and the Nord. Under the hypothetical common market conditions of 1952 it appears to have practically lost its superiority over the Nord, though, as mentioned already, it is possible that the price of Saar coke has been somewhat overestimated. Thus it seems still permissible to conclude that the Saar is a cheaper supplier of coke to Lorraine than the Nord.

The availability of Ruhr and Saar coke is the basic precondition of reorganization. In 1949, of the 7·5 million tons of coke consumed by the Lorraine blast furnaces, only 2·5 million tons came from the Ruhr and 0·8 million tons from the Saar. Given, however, the 1951–2 rate of expansion of the coke output in the Ruhr and the Saar, these two districts should, by 1953–4, be able to increase their contributions to 5·8 million

[1] These are more important here than in the case of Belgium; several steel furnaces in the Saar are of the open-hearth type—important advantages arise from the integration of coke-ovens with open-hearth steelworks.

tons and 1·6 million tons respectively.[1] By that time Lorraine coke requirements will have increased to, perhaps, 9·4 million tons, and so the imports from the Ruhr and the Saar required to eliminate Nord coke completely must be put at about 7·5 million tons and 1·9 million tons respectively. Thus the complete substitution of Ruhr and Saar for Nord coke will probably be delayed until after 1954—but the delay need not be long.

The changes in the composition of coke supplies suggested in the preceding paragraph should reduce the cost of coke per ton of pig-iron. If the authors of the Schuman Plan assumed that general economic conditions would remain stable between 1950 (when they were at work) and 1953/4 (when they could have expected the reorganization of coke supplies to take place), they could look forward to a fall in this cost of between $2.22 (13 per cent.) and $3.20 (20 per cent.)[2] from the level of $16.05 prevailing in France in the first half of 1950. In the middle of 1952 the comparison of the actual cost of coke to Lorraine blast furnaces (about $21 per ton of pig-iron) with the estimate of this cost under common market conditions shows a slightly greater saving—about $2.67 in the case of the partial, and about $3.41 in that of the complete, elimination of Nord coke.[3,4]

2. Iron Ore.[5] Table III sets forth ore prices per ton of iron content for delivery to blast furnaces in various pig-iron producing regions. Plain figures are actual prices obtaining in the first half of 1950 recalculated per ton of iron content; figures in brackets show prices adjusted to eliminate the effects of dual pricing, subsidies, &c. This table may be taken as summarizing the structure of ore prices at the time when the negotiations over the Schuman Plan were in progress.

There is no case for any change in the ore supply arrangements in France. Lorraine ore, which accounts for 95 per cent. of the total ore consumed, is the cheapest for most blast furnaces; it is, moreover, self-fluxing. The ores mined in western France are mostly used in the blast furnaces at Caen, where they are indeed the most economic. Lorraine ore is the cheapest also for the Saar. In 1949–51 the Saar blast furnaces used small quantities of Normandy and German ores; this was probably due to the

[1] In the first half of 1952 French coke imports from Western Germany ran at the annual rate of 3·5 million tons and from the Saar at the rate of 0·8 million tons.

[2] The figure of $2·22 assumes only the partial reorganization of supplies: Ruhr coke, 5·8 million tons; Saar coke, 1·6 million tons; Nord coke, 2 million tons. The figure $3.20 assumes complete elimination of Nord coke. Coke prices used in these calculations are those given in Table II, section B, and the quantity of coke per ton of pig-iron is put at 1·020 ton.

[3] These estimates are based on coke prices as in Table II, section C.

[4] No account has been taken of the possibility of using Lorraine's own coal for coking; techniques to allow this are being developed.

[5] This sub-section will ignore the question of the availability of ore supplies. This problem will be dealt with separately in sub-section 4.

shortage of Lorraine supplies, and the use of the more expensive ores is likely to cease when the position becomes easier in that respect.

TABLE III

Delivered Prices of Iron Ore (*$ per ton of iron content*)

Consuming district	*Origin of ore and per cent. of iron content*					
	Lorraine 32·5	*Western France 48*	*Luxembourg 27·7*	*Western Germany 30*	*Sweden 63*	*French North Africa 50*
France, av.	8.62 (8.92)	12.12	..	..	..	19.50
Lorraine	.. (7.00)	..	..	..	..	..
Saar	8.86 (10.00)	13.45	..	31.77 (17.33)	..	..
Belgium, av.	14.40 (14.25)	14.17*	14.22 (14.22)	..	13.62	19.24
Luxembourg	7.07 (7.07)	..	7.73 (7.73)	..	16.09	..
W. Germany†	.. (11.59)	17.73*	14.76 (12.85)	16.43 (16.43)	14.70	19.68

Notes: The method of considering prices per ton of iron content eliminates the *main* differences in quality but fails to make allowance for some other differences; the figures in the table are therefore only roughly comparable.

The source is E.C.E., *Economic Bulletin for Europe*, vol. ii, No. 2, pp. 31–33, but adjustments have been made for all cases of known discrimination—home prices ex-subsidy have been taken as universally applicable under common market conditions. The transport cost of ore from Lorraine to the Ruhr has been put at $1.75, based on the freight from Luxembourg to the Ruhr adjusted for the difference in distance.

* It is possible that these prices include an export surcharge which, however, is probably moderate. Information on the basis of which an appropriate adjustment could be made is not available.

† The figures are averages for Western Germany, but the weight of the Ruhr is very high—over 80 per cent.

In Luxembourg the bulk of ore supplies has always been provided by local and Lorraine mines, but, since the war, Swedish ore has been used in significant quantities. Thus, in 1949–50 about 15 per cent. of ore used was of Swedish origin in spite of the fact that this ore was more than twice as expensive as Lorraine or Luxembourg ores. There are important advantages of including a certain proportion of high-grade ore in the blast furnace charge, and in 1949–50 the lack of cheaper supplies together with the economies in coke consumption which the use of rich ores allows may have been additional reasons. A certain reduction in the use of Swedish ore may be economical, but generally it appears that the Schuman Plan will bring practically no change in the structure of ore supplies in Luxembourg.

In 1950 Sweden was the cheapest supplier of ore to Belgium with a price advantage of $0.60 per ton of iron content over both Lorraine and Luxembourg ores; and, it must be remembered, there are incidental advantages of using rich ores. In 1952 the position was entirely different: the delivered price (per ton of iron content) of Luxembourg ore was about one-third and that of Lorraine ore less than one-half of the price of Swedish ore on the same basis. It is true that Swedish ore is subject to dual pricing which exaggerates its cost to importing countries. Nevertheless, Luxembourg and Lorraine are likely to be the natural suppliers of ore to the Belgian blast furnaces. In so far as the Schuman Plan may be expected to facilitate the development of Lorraine and Luxembourg ore fields[1] the Scheme will tend to reduce the ore cost of Belgian pig-iron producers—but this cost reduction will probably be very small.

There is considerable room for improvement in the case of Germany. Here the most important thing is the extensive use of the poor and expensive German ore—about 80 per cent. of all ores consumed in Germany in 1950 was of German origin. By normal standards the use of this ore is uneconomic; it is at present used because of the ore shortage. Lorraine is the cheapest source of ore supply to Germany. In 1950 the substitution of Lorraine ore for half of the quantity supplied by German sources would have cut the cost of ore per ton of pig-iron from $10.20 to $9.58, i.e. by 6 per cent.; the full substitution of Lorraine ore for German ore would have reduced this cost by about 12 per cent. to $8.97 per ton of pig-iron. In 1952 the price[2] of Lorraine ore at minehead per ton of iron content was $7.30 and the corresponding price[3] of German ore $42. The delivered price of Lorraine ore in the Ruhr on the basis of non-discriminatory pricing may be put at $13 to $15; this shows that the advantages of the suggested substitution are very considerable indeed. The Luxembourg ore may be delivered in the Ruhr at about the same price as Lorraine ore. Both Lorraine and Luxembourg ores are significantly cheaper than Swedish ore delivered in the Ruhr, even if an allowance is made for the effects of dual pricing. The problem of the substitution of Lorraine and/or Luxembourg ores for Swedish ore is, however, less straightforward. Apart from its higher iron content, Swedish ore possesses important qualities which make it particularly suitable for the production of certain grades of pig-iron necessary for the manufacture of certain kinds of steel. Whenever these special considerations are important Lorraine ore is not a good substitute for Swedish ore and the latter must continue to be used in spite of its cost. It may be added that rich ores are also used, mixed with pig-

[1] Cf. sub-section 4, below.

[2] *L'Usine Nouvelle*, Sept. 1952.

[3] Calculated on the basis of the published price of DM. 53 per ton of ore of 30 per cent. iron content.

iron and scrap, in open-hearth steel furnaces. In so far as this use of Swedish ore is concerned, the substitution of Lorraine ore for Swedish ore is impracticable.

On the whole it appears that German blast furnaces can significantly reduce their ore costs per ton of pig-iron by using Lorraine and Luxembourg ores instead of German ore and some Swedish ore. The main obstacle standing in the way of this rearrangement is the shortage of supplies. As in the case of Belgium, the Schuman Plan can be instrumental to the reduction of ore costs of pig-iron in Germany only by stimulating expansion of Lorraine and Luxembourg ore-fields.[1]

3. Scrap. In the production of pig-iron, scrap is a substitute for iron ore, and in the production of steel by the open-hearth process it is a substitute for pig-iron. Since the end of the war scrap has been, in all the countries concerned, more expensive than iron ores,[2] whereas, as a rule, it is cheaper than pig-iron. Thus the use of scrap in blast furnaces (over and above a small proportion, say 0·1 ton per ton of pig-iron, which facilitates the process and makes possible some saving on coke) generally raises the costs of production of both pig-iron and steel.

Table IV shows on the basis of the conditions of the first half of 1950 the reduction in pig-iron costs which may be expected to result from a decrease in the use of scrap in blast furnaces to 0·1 ton per ton of pig-iron.

TABLE IV

Effects of the Reduction in the Use of Scrap (*$ per ton of pig-iron*)

Country	*Reduction in use of scrap** (*tons*)	*Decrease in scrap costs* ($)	*Increase in the use of iron ore* (*tons*)	*Increase in ore costs* ($)	*Net decrease in raw material costs* ($)
Belgium	0·165	3.10	Lorr. 0·255 Luxb. 0·320	1.97	1.13
Luxembourg	0·044	0.79	Lorr. 0·067 Luxb. 0·076	0.31	0.48
France	0·072	1.01	Lorr. 0·221	0.64	0.37
Saar	0·128	1·71	Lorr. 0·393	1.26	0.45
Germany	0·138	2.40	Lorr. 0·400	1.52	0.88
Germany†	0·138	2.40	W. Ger. 0·433	2.13	0.27

* The difference between the quantities used and 0·1 ton.

† Second-best arrangement considered more likely because of the shortage of Lorraine ore.

These effects are small, but it should be remembered that they represent only a part of the advantage of the reduction in the use of scrap in blast furnaces. Scrap so released will be available for steel-making, and this,

[1] Cf. sub-section 4, below.

[2] In the first half of 1952 the price of scrap in Germany was slightly lower than the price of German ore per ton of iron content; it was nevertheless higher than the average cost of ore.

since scrap is cheaper than pig-iron, will reduce the costs of producing open-hearth steel. What is important at this juncture is that the net effects on pig-iron costs are uniformly postive[1]—nothing offsets the gains accruing at the higher stage. Between 1950 and 1952 scrap prices in Belgium, Luxembourg, France, and probably the Saar rose more than the relevant ore prices. The benefits of the suggested substitution of ore for scrap in these countries must therefore be rated higher than shown in Table IV. On the other hand, in Germany the rise in ore prices exceeded that in the price of scrap; the effects of the substitution of ore for scrap are therefore likely to be smaller than estimated, indeed very small.

Scrap is a substitute for pig-iron in the production of steel by the open-hearth process; on the other hand, only very small quantities of scrap can be used in the Bessemer process. Normally the countries producing steel by the open-hearth process are unable by themselves to satisfy their scrap needs while those relying on the Bessemer method have scrap surpluses.[2]

Ever since the end of the war scrap has been scarce in Western Europe—much scarcer than before the war. Owing to the shortage of iron ores and of coke, the use of scrap in blast furnaces has been very heavy; France developed the open-hearth section of her steel industry, and in Holland the newly established steel industry uses the open-hearth and electric processes.

In so far as future prospects are concerned, it appears that normal scrap supplies (i.e. circulating, process, and capital scrap) of the six countries of the Community may rather more than cover their estimated requirements,[3] but it is only on very favourable assumptions that a significant surplus can be expected. Thus scrap supplies should be used most economically,

[1] No allowance has been made for the effects on pig-iron production costs of the increased coke consumption due to the substitution of ore for scrap because the information required is lacking. On the other hand, allowances have not been made for certain factors likely to reduce coke requirements, e.g. the use of better ore in Germany, of higher quality coke in France and Luxembourg, &c. On balance there may be no significant increase in coke costs in these countries. In Belgium and in the Saar these mitigating circumstances are lacking and, moreover, in the case of the Saar the net reduction of costs due to the substitution is small.

[2] The supply of scrap originates largely in steel-processing (circulating scrap) and in the engineering and shipbuilding industries (process scrap). The quantities of these two kinds of scrap are proportional to the output of crude steel—23 and 12 per cent. respectively. Together they account for about 75 per cent. of the total scrap supply.

[3] The requirements are estimated by applying to the target steel output for 1953 the ratios of scrap per ton of steel as they were in 1950; scrap requirements of blast furnaces are put at 10 per cent. of the target pig-iron output in 1953; scrap needs of iron foundries are added. Scrap supplies are estimated on the assumption that the ratios between the output of crude steel and scrap are: circulating scrap, 23 per cent.; process scrap, 12 per cent.; capital scrap, 15 per cent. (the theoretical availability of old scrap depends on steel production 15–20 years earlier, but the rate of collection depends largely on the availability of new steel for replacements). It is assumed that no process and capital scrap can be supplied by Luxembourg, and the Saar is included in France. Scrap supplies by iron foundries, &c., are added. The results of these calculations can at best be roughly approximate.

i.e. normally scrap should be used in steel-making proper and not in blast furnaces.[1] Indeed, it is only if this rule is strictly observed that the Schuman Community can achieve independence of outside scrap supplies the availability of which in the immediate future is very doubtful.[2]

If the redirection of scrap from blast furnaces to steelworks is accompanied by an appropriate increase in the consumption of ores by blast furnaces, the output of pig-iron will not be affected while the total supply of ferrous materials to steelworks will increase, making possible an expansion of steel output. But even if the redirection could only be achieved at the cost of a reduction in pig-iron output, it would nevertheless be advantageous—the steel output would be maintained and its production would be cheaper.

Undoubtedly many measures suggested above, and therefore many of their effects, could be achieved without any special scheme of market unification. But the arrangements envisaged by the Schuman Treaty will stimulate the process. Economic incentives now often lacking will be created which will induce entrepreneurs to do their best to reduce costs. Moreover, as long as the scrap shortage lasts, the powers of the High Authority to allocate scrap supplies provide a guarantee that this scarce material will not be used in a wasteful manner. This is important, as it is possible that the shortage of scrap will continue for some time.

On the whole, although much *might* be done by each national iron and steel industry acting by itself, there appears to be a much greater likelihood that things *will* be done under the régime of the Community.

4. The availability of iron ores. The reorganization of ore supplies envisaged in sub-section 2 and the substitution of ore for scrap suggested in sub-section 3 require for their implementation a considerable expansion of Lorraine and Luxembourg ore outputs. On the basis of the pig-iron outputs planned for 1953 it appears that to permit a partial substitution of Lorraine and Luxembourg ores for German ore in Western Germany and for overseas ores in Belgium the ore output of Lorraine must reach 47–48 million tons and that of Luxembourg 5·5 million tons. To secure to all member countries full access to the cheapest sources of supply the Lorraine output must increase to 55 million tons and the Luxembourg output to 7·5 million tons. In the first half of 1952 the Lorraine ore output ran at the annual rate of 49·5 million tons (17 million tons above the actual output of 1951) and the Luxembourg output at the rate of nearly 7 million tons (1·5 million tons above the output of 1951).[3]

[1] Except for small quantities—say 0·1 ton of scrap per ton of pig-iron—this is really necessary in the blast-furnace process.

[2] E.C.E., *An Analysis of Trends in Europe's Supply and Consumption of Iron and Steel Scrap*, p. 12.

[3] Cf. E.C.E., *Quarterly Bulletin of Steel Statistics*, Sept. 1952.

Very little has been released about the plans to expand the production of iron ores, but the output figures for the first half of 1952 suggest that the end of the shortage of Lorraine and Luxembourg ores may well be in sight. The Schuman Plan may facilitate the final advance in this direction by making available for the development of the Lorraine ore-field additional resources of labour and capital—those which would otherwise be used to develop and keep in operation the ore mines in Germany. In so far as the development of the Lorraine ore-field depends on the availability of labour and capital, the co-operation between France and Germany may greatly reduce the difficulties with ore supplies. Moreover, since productivity is considerably higher in Lorraine than in the German mines,[1] the ultimate saving in terms of labour and capital is likely to be appreciable. The Schuman Plan may thus facilitate the overcoming of the ore shortage and this, in turn, is the basic precondition for the reorganization of ore supplies in accordance with strictly economic principles.

5. The effects on costs of pig-iron production. Table V shows the structure of raw material costs of pig-iron as it was in the first half of 1950 and as it would have been at that time under common market conditions.

This table indicates that when the negotiations over the Schuman Plan started there existed substantial opportunities for improving the structure of supplies of steel-making materials. These opportunities consisted of the substitution of Ruhr for Nord coke in France and of the substitution of Lorraine and Luxembourg ores for more expensive ores used in Germany and Belgium. Cost reductions due to these changes in the structure of supplies would have been supplemented by reductions in the prices of Nord and Belgian coke and by the effects of the elimination of dual pricing.

Owing to the lack of detailed information, only a very general estimate of the probable effects of the market unification on the raw material costs of pig-iron can be made on the basis of 1952 conditions. Thus the reduction of coke costs in France is likely to be slightly greater than estimated for 1950; in Germany the substitution of Lorraine ore for German ore seems now to be much more profitable than appeared possible in 1950, and in all countries except Germany the benefits due to the substitution of ore for scrap in blast furnaces seem likely to be substantially greater than their estimates based on 1950 conditions. On the whole it is permissible to conclude that the changes which took place between the conception of the Schuman Plan and the time at which it is being put into effect have significantly increased the advantages of the Scheme and therefore its importance for the economy of Western Europe.

[1] Ore output per man-year, 1948, tons: France, 1,266; Bizone, 526. Iron output per man year: France, 420; Bizone, 139. Cf. E.C.E., *European Steel Trends in the Setting of the World Market*, p. 48.

TABLE V

Main Raw Material Costs of Pig-Iron ($/ton of pig-iron)

	Western Germany	*France*	*Saar*	*Belgium*	*Luxembourg*
A. First half of 1950. Actual costs					
Coke	10.54	16.05	13.02	12.86	16.14
Ore	10.20	7.76	7.80	10.28	9.12
Scrap	4.14	2.41	3.05	4.98	2.59
Total	24.88	26.22	23.87	28.12	27.85
B. Common Market—Hypothetical 1950 conditions					
Coke	10.54	12.85*–13.73†	13.02	10.11	11.98
Ore‡	10.49§–11.71‖	8.40	9.60	12.25	9.43
Scrap	1.74	1.40	1.34	1.88	1.80
Total	22.77–23.99	22.65–23.53	23.96	24.24	23.21
% change on actual costs	−8·5 −3.6	−13·6 −9·5	+0·4	−13·8	−16·6

Notes: Section A represents the situation as it was in the first half of 1950 (cf. E.C.E., *Economic Bulletin for Europe*, vol. ii, No. 2, p. 35). Section B shows the estimates of these costs as they would have been had all measures of reorganization suggested in this paper been introduced at that time. They are based on the data set forth in Tables II (B), III, and IV.

* Reflects complete elimination of Nord coke; cf. p. 176.

† Reflects partial elimination of Nord coke; cf. p. 176.

‡ Cost increases are in most cases due to the use of greater quantities of ore in substitution for scrap. In the case of the Saar the removal of subsidy enjoyed in 1950 is allowed for.

§ Reflects complete elimination of German ore; cf. p. 178.

‖ Reflects only partial elimination of German ore; cf. p. 178.

The costs of coke, ore, and scrap together account for about 75 per cent. of the total costs of pig-iron. The reduction in raw material costs must therefore noticeably affect the total; the unification of the market as envisaged by the Schuman Plan may reasonably be expected to make pig-iron cheaper in all the member countries concerned.

6. Italy and the Netherlands. Owing to the lack of relevant information, only very general comments may be made on the problem of pig-iron production in Italy and Holland.

In Italy the cost of home-produced ore per ton of pig-iron is, at present, probably not higher than it is in the other countries. But the Italian ore-fields are gradually approaching exhaustion and so the efficiency of mining is likely to fall, causing a rise in the price of ore. The costs of imported ores are, and are likely to remain, higher than the average ore costs in other countries. For coke Italy must rely wholly on imports. In 1950 the cost of coke per ton of pig-iron was much higher in Italy than in other countries and, even though this was partly due to artificial factors (dual pricing, &c.), there is little doubt that it will remain significantly higher

under common market conditions. Thus it appears that the price of German or French pig-iron delivered to Italian steelworks may well be lower than the delivered price of Italian pig-iron. The proper economic arrangement therefore lies in a gradual elimination of most Italian blast furnaces, French and German producers undertaking the task of supplying the Italian market.

Holland produces enough coke fully to satisfy her requirements; moreover, she produces it very cheaply so that, in spite of the fact that the quantity of coke used per ton of pig-iron is greater than elsewhere, the cost of coke per ton of pig-iron is probably rather lower than in other countries. On the other hand, the combined cost of ore and scrap per ton of pig-iron was, in 1950, higher than in the other countries. An improvement in this respect is, however, possible: it lies in the substitution of Swedish, North African, and Spanish ores for the more expensive ones which had to be used in 1950 owing to the ore shortage. Generally speaking, it appears that Holland is likely to be as efficient in the production of pig-iron as the other members of the Community.

VI. Crude and Finished Steel Production

The effects of the pooling of the iron and steel industries on the structure of crude and finished steel production will undoubtedly be many and various. Two problems must be considered: the possibility of greater specialization, and the co-ordination of investment policies by the High Authority.

1. Specialization. The problem of specialization may be considered by reference to optimum sizes of various steel plants in relation to national and total (i.e. Schuman Community's) demand for the products of these plants. To attain optimum efficiency a steel plant must be able to produce one or at most a small number of similar products in large quantities. That is to say, to be efficient steel plants must be large and specialized. Thus, generally speaking, the optimum size of a plant producing flat products by the continuous-strip process is about 1·3 million tons per annum (crude steel equivalent); for a plant producing heavy sections it is 0·6 million tons per year; and for a plant producing light sections, 0·5 million tons.[1] Actually the total capacity to produce these products may be estimated as shown in Table VI.

The writer has been unable to discover exactly how many and what plants producing these goods are in operation in the Schuman countries, but it is certain that there are several of them and that in many cases they are small and obsolete. Undoubtedly there are great opportunities to raise

[1] Cf. E.C.E., *European Steel Trends in the Setting of the World Market*, p. 61. The composition of output is also very important in this respect.

TABLE VI

	*Thin flat products (000 tons)**	*Heavy sections (000 tons)*	*Light sections (000 tons)*
Belgium	1,140	264	1,524
Luxembourg	300	516	1,140
France	2,064	624	2,964
Saar	372	252	696
W. Germany	2,760	996	2,964
Netherlands	348†	..‡	..‡
Italy	420	156	1,028
Total	7,404	2,808	10,316

Notes: These figures represent the annual output capacity computed on the basis of the best monthly output as recorded between April 1951 and March 1952.
* Strip and sheets.
† Strip, plates, and sheets.
‡ Heavy sections, light sections, and wire rods, 168,000 tons.
Source: E.C.E., *Quarterly Bulletin of Steel Statistics*, Sept. 1952.

the efficiency of this branch of the industry by co-ordinating development in such a way as to concentrate output in a small number (6–8) of modern, large plants. Unfortunately the plans prepared in 1945–7, which are now being executed, were drawn up separately by each of the participating countries; the examination of these plans by the O.E.E.C. and the E.C.E. did not produce material changes in the direction of their co-ordination. Under these plans nine new plants to produce flat products have been or are being constructed, but only two of them (in France) are the most modern continuous-strip mills of optimum size; others, though no doubt better than most of the existing plants, are likely to be too small to attain optimum efficiency. It is not suggested that there will be excess capacity in 1953–4: in 1951–2 the demand for flat products—particularly sheets—exceeded their supply, and consequently the capacity figures underestimate the market; the demand for flat products has recently been steadily increasing and the needs of rearmament will strengthen this trend; lastly, some of the capacity in use in 1951 will be fit only for the scrap-heap in 1953–4. Even if excess capacity does not arise, it cannot be hoped that costs will be reduced to a minimum; the new capacity will not take the most economic form of large, specialized, most modern mills, but mostly that of technically less excellent mills which, having a smaller optimum size, were, not surprisingly, preferred by planners working on the assumption of national markets. It is unfortunately too late now to make other than minor changes because the execution of the development plans is already very far advanced. Even though it may in some cases be possible to operate on a specialized basis plants originally designed to be more universal, it is clear that owing to the lack of co-ordination opportunities

for considerable improvements in the efficiency of this branch of the steel industry have been missed. This does not mean that there will be no more room for economies. Replacements and expansion will, of course, take place after 1953–4—some plans explicitly provide for further expansions and new plans are being prepared. The co-ordination of these investment activities will continue to be the key to improvements in efficiency. But the effects of this piecemeal action will emerge only very slowly and gradually.

These observations apply also to 'heavy sections'. These, too, are often produced on a scale inadequate to secure the fullest efficiency. And again, this is due to the fact that during the last 25 years, production has been planned by reference to national markets, too small to justify the establishment of mills of optimum size.

The structure of the 'light sections' branch of the industry offers, at first sight, much less scope for reorganization. The national markets are apparently large enough to permit the operation of optimum-sized plants. The term 'light sections', however, covers a very wide variety of products. Their production sometimes requires entirely different equipment, and, in any case, the switching over from one process to another takes time and effort. Efficiency requires considerable specialization within the 'light sections' branch of the industry—needless to say, the larger the market the farther can specialization be pushed and so the greater are the likely economies.

2. The co-ordination of investment plans. The establishment of the Schuman Community will open important opportunities for specialization. But the crucial problem is to ensure that these opportunities are taken. In this connexion it is necessary to examine the provisions of the Schuman Treaty concerning the powers of the High Authority and of the other organs of the Community over the forming and execution of investment plans. Although the High Authority can neither formally forbid the implementation of investment plans of individual firms nor compel them to undertake investments which do not appeal to them, indirect powers and rights appear sufficient to ensure compliance with its views and wishes.

In the first place the High Authority will be entitled to be fully informed about the plans of all firms and will make public its opinions about them. An unfavourable opinion of a highly expert and well-informed body will undoubtedly have a cooling effect on the proposing firm itself and will make the raising of capital to finance the project very difficult, if not impossible. Moreover, the High Authority will in certain cases[1] be entitled

[1] Namely, if the investment in question appears to require for its success subsidies, grants, protection, or discriminatory advantages incompatible with the provisions of the treaty.

formally to prohibit the use of *outside* funds to finance the investment in question. It would be a very bold firm that would proceed in the face of such obstacles.

Secondly, the High Authority will be entitled to make loans to individual firms and to guarantee on their behalf loans raised by them in the ordinary way. Assuming that the High Authority will not be under political pressure it will, no doubt, make these special facilities available only to firms desiring to undertake investments it has previously approved and commended, i.e. those expected to contribute to the rationalization of the industry.

Thirdly, the High Authority will also be entitled to help by loans and guarantees, and sometimes by grants,[1] in the financing of investments designed to facilitate the re-employment of workers thrown out of work by the process of rationalization and reorganization of the coal and steel industries. These investments need not necessarily be in the coal and steel industries themselves; but to assist investments outside them the High Authority will have to obtain special approval of the Council of Ministers. This suggests that at least some 're-employment investments' will be made in these two industries.

Finally, the High Authority, once it secures the respect and confidence of the industry, will be able to do much by guidance and advice on the preparation of investment plans. It appears, therefore, that if the High Authority proves itself an expert body with a strong collective personality, resolute and vigorous in the exercise of its functions, and if it is not hampered in its tasks by political pressure or special considerations, it will probably be able, given reasonable time, substantially to improve international specialization in the steel industry. And this is the most important channel through which the general cheapening of finished steel can be achieved.

VII. Conclusions

The Schuman Plan offers important opportunities for improvement in the present pattern of the utilization of scarce resources. Capital and labour will be saved by the concentration of mining operations in coal and iron-ore mines and fields where conditions favouring the highest productivity are present. Looked at from another standpoint, this concentration, when carried out, will make possible significant reductions in coal prices and in the cost of iron ores to its users. The creation of a single,

[1] Out of funds accumulated by levies on output. Grants will be paid only if the governments concerned contribute equal sums for the purposes in question.

competitive, and not-discriminatory market will permit all buyers to purchase coal, iron, and steel from the cheapest and best sources.

It might appear, at first sight, that the Schuman Plan is merely a spectacular scheme for the abolition of tariffs, quotas, and discriminatory arrangements. In fact it is much more than that. Within the framework of the Schuman Plan the unification of the market will, it is hoped, be regarded as permanent—a belief which a simple abolition of trade barriers cannot, nowadays, be expected to secure. And the belief in the permanence of market unification is of utmost importance—it is a precondition of the adjustment of the structure of production to the conditions of demand in the common market. Moreover, the Schuman Plan provides for special arrangements to deal in a co-operative and co-ordinated manner with emergencies which might otherwise give rise to nationalistic and isolationist policies. Finally, the Schuman Plan not merely establishes the free-trade framework for the commodities concerned; it also creates conditions and machinery for co-ordinated development policies in these industries. The international character of the central authorities of the Community raises hopes that these policies will not be conditioned by nationalistic premisses. This is particularly important in the steel industry because the national markets are often too small to justify the building of specialized plants of optimum size. A simple abolition of trade barriers can create many opportunities for improvement in the economic structure of the coal and steel industries, but the Schuman Plan will, in addition, in many ways facilitate or even enforce the taking of these opportunities. Therein lies its main superiority over the simple abolition of trade restrictions.

It is important to note that the disadvantages and burdens of the reorganization are unlikely to be heavy. Unemployment resulting from the abandonment of high-cost mines in France and Belgium will not be very large and its emergence will be spread over a period of considerable length. Moreover, the Schuman Plan provides for the initiation and financing by the High Authority of retraining and resettlement schemes to facilitate the re-employment of redundant workers. Similarly, financial assistance is to be provided to the owners of abandoned collieries and works; this is designed to facilitate their transfer to other lines of business activity.

The Schuman Plan is immensely important politically. It represents an attempt at co-operation between the nations of Western Europe unprecedented both in scope and in character. The attainment of such a goal is worth very much. But, in the writer's opinion, there is no question of sacrificing genuine economic interests for the sake of a political aim. If in practice the new organization successfully expresses the spirit of the treaty

which created it, then, apart from the political benefits which the existence of the Scheme may reasonably be expected to yield, it will be the source of many important advantages to the economy of Western Europe as a whole and to that of each of the member countries that comprise the Community.

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PRODUCTION COSTS IN THE GAS INDUSTRY[1]

By T. K. GRIBBIN

PART I

THE gas industry is an example of an industry manufacturing joint products. The main product of the industry is, of course, town gas,[2] and the subsidiary product is the group of by-products or residuals, such as coke, tar, benzole, &c. Consequently the statistical analysis of production costs is a complicated affair, as some of the factors which determine these costs show a high degree of interrelation. This part describes an attempt which has been made to use multivariate analysis and confluence analysis in order to assess the relative influence of certain factors which common observation suggests contribute towards the determination of gas production costs.

The data used are derived almost entirely from the annual accounts of the East Midlands Gas Board. The collection of forty-five undertakings considered includes only those undertakings which manufactured gas and which had sales of over 100,000 therms in the accounting period considered (11 months from May 1949 to April 1950). These forty-five undertakings can be taken as fairly typical of the gas industry before nationalization, as it is hardly likely that 11 months' control by the new Board would severely alter the pattern of production costs.

The accounts of a gas undertaking are usually set out in the following logical order.

Gross cost of coal, less net revenue received from residuals

$$= \text{net cost of coal.}$$

Net cost of coal, plus production costs (including direct labour costs), plus maintenance of plant and buildings

$$= \text{net cost of gas sent into holder.}[3]$$

The net cost of distribution, general consumer service, and direct administration is added to net cost into holder to obtain a total which is roughly equal to total operating cost.

[1] This article is part of the work which was done whilst I was Assistant Statistician in the Commercial Manager's Department of the East Midlands Gas Board. The Board does not, of course, necessarily accept responsibility for any of the conclusions shown below. I should like to express special thanks to Mr. H. R. Hart, Commercial Manager of the East Midlands Gas Board, for his advice and encouragement.

[2] Town gas is so described to distinguish it from its components, which can be (1) coal gas; (2) water gas, i.e. gas made from coke and steam; and (3) gas purchased from coke ovens.

[3] Net cost into holder is often used as a rough approximation to average variable costs in the 'medium' run, in the sense that it is regarded as the lower limit to be set to marginal prices.

Thus, in calculating the production cost of making gas (or net cost into holder) coal is treated in the accounts as though it was bought at a net price from the department responsible for selling the residual by-products.

The absolute figures for the various cost items are usually converted to a relative basis by dividing throughout by the number of therms of gas sold to consumers or to other gas undertakings. Thus costs are now expressed in pence per therm of gas sold. However, it is clear that this conversion contains the implicit assumption that the difference between gas made by the undertaking and gas sold is a constant proportion throughout a given area. In practice this gas not accounted for is usually about 6–7 per cent. of gas made, but this proportion varies from undertaking to undertaking.[1]

Table I sets out the weighted average production costs in pence per therm sold for forty-five undertakings of the East Midlands Gas Board arranged in five groups according to size. From column 9 there appears to be some connexion between the general efficiency of an undertaking and its size, the net cost into holder falls continuously (with the exception of group D),[2] and net cost of group E is 64 per cent. of group A.[3] Generally speaking, most of the constituent cost items fall as the size group increases. The most important item in the table is the gross cost of coal. The gross cost of coal to group E is nearly 4*d*. per therm below the gross cost of coal to group A.

It is interesting to see from columns 1 and 2 that there is apparently a direct relation between the gross cost of coal and the net revenue received from residuals. The revenue from residuals falls as the group size increases. However, this fall in revenue from residuals is not proportionately greater than the fall in gross cost of coal and consequently, as column 3 indicates, the net cost of coal also falls as the group size increases.[4]

The lower gross cost of coal in pence per therm of gas sold at the larger undertakings is the result of two main factors: firstly the larger undertakings produce more therms of gas from each ton of coal, and secondly the rail and unloading charges are lower at the large undertakings than at

[1] This is gas not accounted for after gas used on the gas-works has been deducted. The main sources of loss of gas are (*a*) leaking gas mains and (*b*) the failure of many gas meters to register small flows of gas, e.g. the regular consumption of a pilot light. Some very small gas-works lose about 50 per cent. of the gas sent out from the works because of leaking gas mains.

[2] Some of the undertakings in group D made carburetted water gas as a supplement to coal gas throughout the year. Carburetted water gas is usually regarded as a supplement to the total supply of gas in the winter peak period only. The prime cost of carburetted water gas, which is made from oil and coke, is about double the prime cost of coal gas. As can be seen from column 4 of Table III, the cost of this carburetted water gas is about 0·5 pence per therm of all gas sold above the similar cost for the groups C and E.

[3] The correlation between size and net cost into holder is −0·63 (Table V).

[4] The correlation between size and net cost of coal is −0·33 (Table V).

the small undertakings. This is due to better site positions and the use of mechanical handling equipment.

Further, the lower revenue from residuals at the larger undertakings reflects firstly the higher efficiency of the largest undertakings (as above), and secondly the higher average prices which are obtained from the by-products which are sold at the smaller undertakings. This is because coke and tar, &c., are sold in small amounts at the smaller gas-works and are not usually sold in bulk to wholesalers.

Column 5, headed 'carbonization', shows labour costs which are directly associated with the production of gas in the retort house. Labour costs for the smallest group (A) are more than 2*d*. per therm higher than the labour costs incurred by group E, the group containing the largest undertakings.[1]

A further aspect of the apparent economic superiority of the larger undertakings is the fact that expenditure on repair and maintenance of plant and buildings falls as the group size increases. However, as many repair items are of a 'once and for all' nature, it is perhaps unwise to generalize on the basis of the accounts of a single year.

The general impression which emerges from a consideration of Table I is that the larger undertakings tend to have lower constituent cost items than the smaller undertakings.

Having established that the larger undertakings have in general lower costs than the smaller undertakings, the next step is to examine the *structure* of production costs to see if any valid generalization can be made.

Table II sets out the cost figures of Table I[2] in percentage form, taking net cost into holder as 100. No clear change in cost structure is apparent as we move down the table from group A to group E; in fact it seems that the structure of costs between undertakings is remarkably stable. The conspicuous exception to this is the proportion of net cost into holder which is taken up by carbonization costs.[3] Direct labour costs[4] are three times more important (as a percentage of net cost) to the smallest undertakings than they are to the largest undertakings.

The most important constituent cost item is the net cost of coal; this is about half of the total net cost into holder. In every case the gross cost of coal is greater than net cost into holder and the revenue received from the sale of residual products is greater than the sum of the items in columns 4–8. The gas industry in the last 30 years has become more sensitive to fluctuations in the revenue received from the sales of by-products.

[1] The correlation between size and output per retort-house worker of gas is +0·83.
[2] See 'Notes on Tables I–IV' for an explanation of the headings in these tables.
[3] The differences under the heading 'C.W.G. manufacture' are not, in fact, systematic.
[4] See 'Notes on Tables I–IV'.

This is mainly because of the growth of the industry's dependence on the coke ovens for quantities of gas. In some areas, notably the East Midlands and the Northern Gas Boards, half the gas which is available for distribution comes from the coke ovens. Under normal conditions coal gas issues from the coke ovens as a by-product of the manufacture of coke. This position would be reversed if, say, the demand for steel, and consequently the demand for coke-oven coke, were to fall off. In this event the need to maintain supplies of gas by taking gas from coke ovens would render coke the by-product. This would reduce the market price for certain types of coke and tend to increase the net cost of manufacturing gas at a gas-works.

Tables III and IV set out the additional items which, when added to net cost into holder, make up total operating cost in pence per therm. These are given both in absolute amounts and in percentages.

The two items, rates and the cost of collection, show a fair degree of steadiness as we move from the smaller to the larger undertakings. It is generally believed that the cost of collection for the larger undertakings is higher than the cost for the small undertakings on the grounds of diseconomies of scale. This belief is not supported by the figures shown in column 3, Table III; and further (again contrary to the common belief), column 4, Table III shows that for these forty-five undertakings the group which makes the largest net surplus on the net cost of general consumer service is the group of the smallest undertakings.[1]

The two items which show a change with variations in the size of undertaking are the cost of administration of the gas undertaking and the cost of welfare. The relative cost of administration for the largest undertaking is only one-third of that of the smallest undertakings. This seems to indicate a higher degree of utilization of staff employed by the larger undertakings and that there is no administrative 'inability' to control the undertaking as the size of undertakings increases. In short, it does not suggest that an increase in size of undertaking, within the range shown in the tables, leads to 'managerial diseconomies'.

The general impression from Tables I–IV is that the large undertakings are more efficient than small undertakings and that in some items of cost the difference between undertakings of different size is rather great. Examples of these items are the net cost of coal, labour costs incurred directly in the production of gas, and cost of administration.

However, this method of comparing the production cost of undertakings of varying size by means of simple averages is inadequate in many respects. A more refined technique of measuring the degree of association of changes

[1] The type of service at small undertakings is in many instances different from that provided by large undertakings.

in items of production costs with other given variables is provided by correlation analysis.

Correlation analysis can be used to examine the relationship between the level of technical efficiency and the level of prices of materials and services used in gas making and production costs.

The level of technical efficiency can be looked at in three ways: firstly the 'size' of an undertaking can be used as an index of general technical efficiency, i.e. it is a kind of portmanteau index; secondly the output of therms of coal gas per retort-house worker (the worker directly associated with gas making) can be regarded as an index of the use of the labour force on the gas-works; and thirdly the number of therms obtained from each ton of coal carbonized can be taken as an index of the efficiency of gas-making plant.

It is generally assumed by gas engineers that large gas-works are more efficient than small gas-works. This assumption is based mainly on theoretical considerations and rarely on an examination of actual production results. No definite views appear to be held on what the optimum size of gas-works should be.

Particular aspects of the expected general technical efficiency of large gas-works are low labour-costs and a high thermal yield.

At a large gas-works the production of gas is a continuous process in contrast to the 'discrete' methods of production which are often adopted at small works; in addition the greater scale of production of the large works means that the indivisibility in the use of labour which exists at small works can be avoided. Consequently it is to be expected that large gas-works will have lower labour-costs than small works.

Further, it is to be expected that a large works will have a high thermal yield because the technical standard of managers will probably be higher and because a more efficient method of extracting gas can be used, i.e. the hot coke can be steamed *in situ* in a vertical retort.

It is possible to substitute within a certain range therms of gas for therms of coke in the course of production, an increase in the thermal yield of gas giving a decrease in the yield of coke. Consequently it is to be expected that a negative correlation will exist between thermal yields and the revenue from the sale of by-products and similarly between thermal yields and the net cost of coal.

The analysis which follows examines the relation of the net cost of gas into holder and four other variables. Net cost into holder has been taken as the most interesting part of production costs, firstly because there is a greater variation in net cost in holder than in total operating cost (Tables I and III). The difference between net cost into holder and total operating cost in Table III is approximately 2*d*. per therm for each group (except

group B). Secondly, net cost into holder includes most of the costs which change with changes in production in the medium run, i.e. it can be regarded as an average variable cost in the medium run, and thirdly, net cost into holder is regarded by the gas industry as the lowest limit which can be set to marginal prices without incurring any escapable financial loss.

Table V sets out the matrix of simple (or zero order) coefficients of correlation. The variables included have been numbered in the following way:

(1) Log. of net cost into holder in pence per therm.
(2) Log. of size of undertaking measured in therms of gas sold.
(3) Log. of output of coal gas per retort-house worker in therms.
(4) Log. of thermal yield, i.e. number of therms of coal gas obtained from each ton of coal carbonized.
(5) Log. of net cost of coal in pence per therm, i.e. gross cost of coal less net revenue from sale of residuals.

The second row of the matrix confirms the general picture which was obtained from an examination of Tables I–IV. All of the coefficients of correlation shown in this row are significant at the 5 per cent. level and show that as the size of an undertaking increases:

(*a*) The net cost into holder falls.[1]
(*b*) The output per retort-house worker improves.
(*c*) The thermal yield increases.
(*d*) The net cost of coal falls.

The connexions between size and the variables net cost into holder, output per retort-house worker, and thermal yield are shown graphically in the scatter diagrams of Figs. 1, 2, and 3.

The simple correlation coefficients shown in Table V provide the basis for a statistical examination of the influence of variables 2, 3, 4, and 5 in the determination of net cost.

The correlation coefficients between net cost into holder and the other four variables are given in row one of Table V and all of these coefficients are significant at the 5 per cent. level. These correlation coefficients show the connexions which we should expect to find and are in accordance with the picture obtained from Tables I to IV.

The correlation coefficients given in the first row of table V show that net cost into holder falls as:

(*a*) The size of undertaking increases.
(*b*) Output per man improves.
(*c*) Thermal yield increases.
(*d*) Net cost of coal falls.

[1] The correlation between size and total operating cost is — 0·56.

However, from the correlation matrix it is clear that there is a considerable degree of association between the variables other than net cost into holder. In fact, all the correlation coefficients shown in Table V are significant at the 5 per cent. level except 45 (the correlation between net cost of coal and thermal yield). This correlation coefficient does not confirm the expected relationship described on page 194. It is not readily clear why this is so, and to unravel this puzzle would mean an examination of the extent of substitution in production between gas and coke, the thermal 'quality' of the gas supplied to consumers, and the yields of by-products.

As is to be expected, the correlation is relatively high between the three variables: size, output per retort-house worker, and thermal yield. This is because these variables reflect various aspects of the general level of technical efficiency, and also because there is a low degree of productive flexibility in practice for any given gas plant. A rise in the thermal yield of carbonization, for example, may affect simultaneously the amount and quality of residual by-products and also the output per retort-house worker.

Consequently, the classical method of partial correlation used in an attempt to isolate the influence of each of the variables when considered separately is not adequate. This is because the process of individual isolation gives arbitrary results where there is appreciable multi-collinearity between the variables used.

The problem now is to find out if any of the variables 2, 3, 4, and 5 are so related to each other that partial regression and correlation analysis is not permissible. The bunch-map technique has been used to solve this problem, and the results are presented in Fig. 4.

Roughly speaking, the bunch-maps can show three things:

(*a*) Successive groupings of variables which give an improved 'explanation' of factors under investigation. In this case the addition of a new variable helps to close the spread or change the average slope of the spread of the leading beams (marked with a circle, thus ②).

(*b*) Groupings of variables which are 'detrimental' to each other. This is the case when the addition of a new variable to a group causes an 'explosion' of the bunch-map. An example of this is the addition of output per retort-house worker to the variable net cost into holder and size, i.e. in the addition of variable 3 to the set 12.

(*c*) Groupings of variables which can be termed 'neutral' groupings. Here the spread of the leading beams is not reduced (nor the direction of slope changed) and at the same time no explosion effect is shown. The set 125 is an example of such a grouping of variables.

A consideration of all the groups containing three variables indicates that no variable when added to a two-variable group has the effect of

improving the bunch-map. On the other hand, any three-variable group which includes 2 and 3, 2 and 4, or 3 and 4 is explosive and so these particular detrimental groupings cannot be considered together.

The addition of net cost of coal (variable 5) to any of the sets 12, 13, or 14 does not appreciably affect the slope and direction of the leading beams, nor does this variable produce an 'explosion'. Thus the groups 125, 135, and 145 can be considered as 'closed' groups and partial-correlation methods can be used.

The 'explosive' relation between variables 2, 3, and 4 means that one of these variables must be used by itself as an index of general technical efficiency. Thus the movement of one of these variables can be taken as indicating movements of the other two variables.

From Table V it seems that the output per retort-house worker is the best index of general technical efficiency as 23 is +0·83, 34 is +0·46, and both these are higher than 24 (+0·39).

The coefficients of multiple correlation for the three closed groups calculated from Table V are:

$$R\ 1{\cdot}25 = 0{\cdot}73$$
$$R\ 1{\cdot}35 = 0{\cdot}78$$
$$R\ 1{\cdot}45 = 0{\cdot}71$$

The set 135 provides a better 'fit' than the sets 125 and 145, although in a sample of forty-five undertakings it cannot be said that the differences between these coefficients are significant. The most interesting set is 125 which shows the association of the net cost of gas, the size of undertaking, and the net cost of coal; the correlation coefficient between size and the net cost of gas is 0·63 and the addition of the net cost of coal increases the coefficient to 0·73, although a glance at the bunch-maps for sets 12 and 125 shows that the introduction of the net cost of coal does not make much noticeable improvement to the spread of the beams. Since nationalization several area Boards have announced plans for gas grids within their own region. These grids are to link large works and to displace the small and higher-cost works which are within reach of the grid. The correlation coefficient for set 125 confirms in a general way the main assumption of these plans.

Other coefficients of multiple correlation are:

$$R1{\cdot}234 = 0{\cdot}73$$
$$R1{\cdot}235 = 0{\cdot}71$$
$$R1{\cdot}345 = 0{\cdot}81$$
$$R1{\cdot}245 = 0{\cdot}79$$
$$R1{\cdot}2345 = 0{\cdot}81$$

The estimating equations for the three 'closed' sets of variables are:

$$X_1 = 1{\cdot}41 - 0{\cdot}10 \quad X_2 + 0{\cdot}21 \; X_5 \text{ (set 125)}$$
$$X_1 = 1{\cdot}45 - 0{\cdot}21 \quad X_3 + 0{\cdot}21 \; X_5 \text{ (set 135)}$$
$$X_1 = 2{\cdot}56 - 0{\cdot}94 \quad X_4 + 0{\cdot}27 \; X_5 \text{ (set 145)}$$

Where X_1 = Log. of net cost into holder.
X_2 = Log. of size of undertaking measured in therms sold.
X_3 = Log. of output of gas per retort-house worker in therms.
X_4 = Log. of thermal yield in therms of gas per ton of coal carbonized.
X_5 = Log. of net cost of coal in pence per therm.

The partial regression coefficients indicate (*a*) that a 10 per cent. increase in size is associated with a 1 per cent. fall in net cost into holder; (*b*) that a 10 per cent. improvement in the output per retort-house worker is associated with a 2 per cent. fall in net cost into holder; (*c*) that a 10 per cent. rise in the thermal yield per ton of coal carbonized is associated with a 9 per cent. fall in net cost into holder; and (*d*) that a 10 per cent rise in the net cost of coal is associated with a 2–3 per cent. increase in net cost into holder.[1]

Table VI sets out the theoretical and actual net cost into holder for the twenty largest undertakings of the collection considered. The estimating equation for set 135 is used in Table VI because this set gives a better fit ($R = 0{\cdot}78$) than either set 125 or set 145 ($R = 0{\cdot}71$).

[1] It should perhaps be stressed that association does not necessarily imply causal connexion. A comparison of the coefficients of X_4 and X_5 with column 3 of Table II will make this point clear.

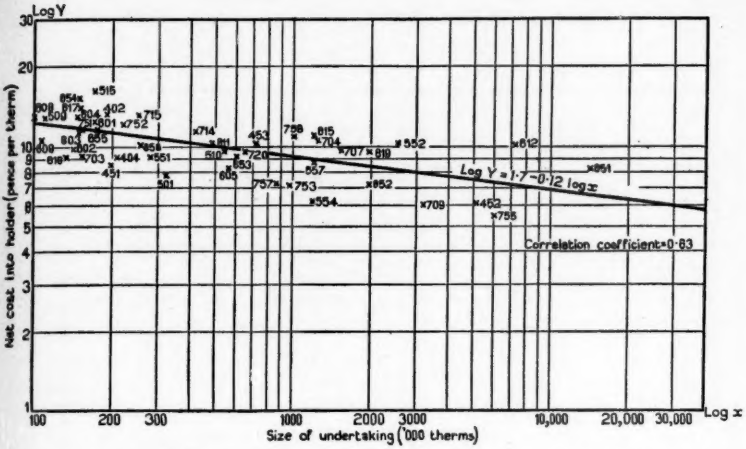
Log Y
Net cost into holder (pence per therm)
Log Y = 1·7 − 0·12 log x
Correlation coefficient = 0·83
Size of undertaking ('000 therms)
Log x

FIG. 1. Relation of net cost into holder and size of undertaking.

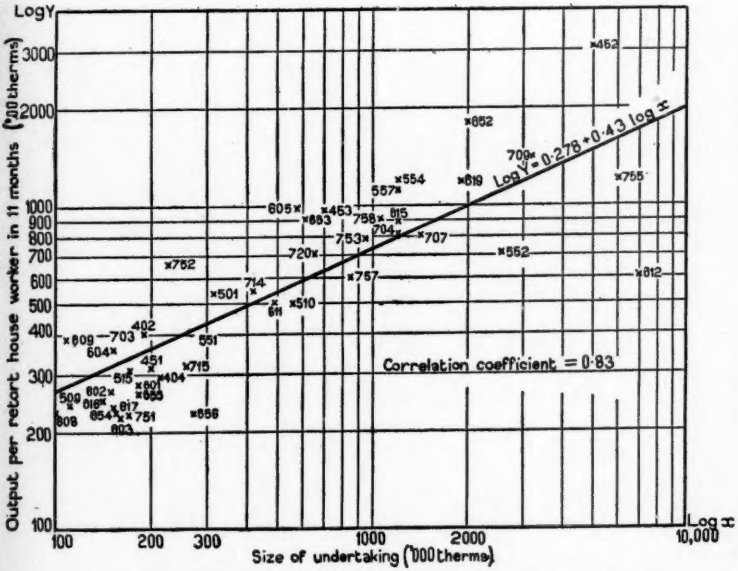
Log Y
Output per retort house worker in 11 months ('00 therms)
Log Y = 0·278 + 0·43 log x
Correlation coefficient = 0·83
Size of undertaking ('000 therms)
Log x

FIG. 2. Relation of output per retort-house worker and size of undertaking.

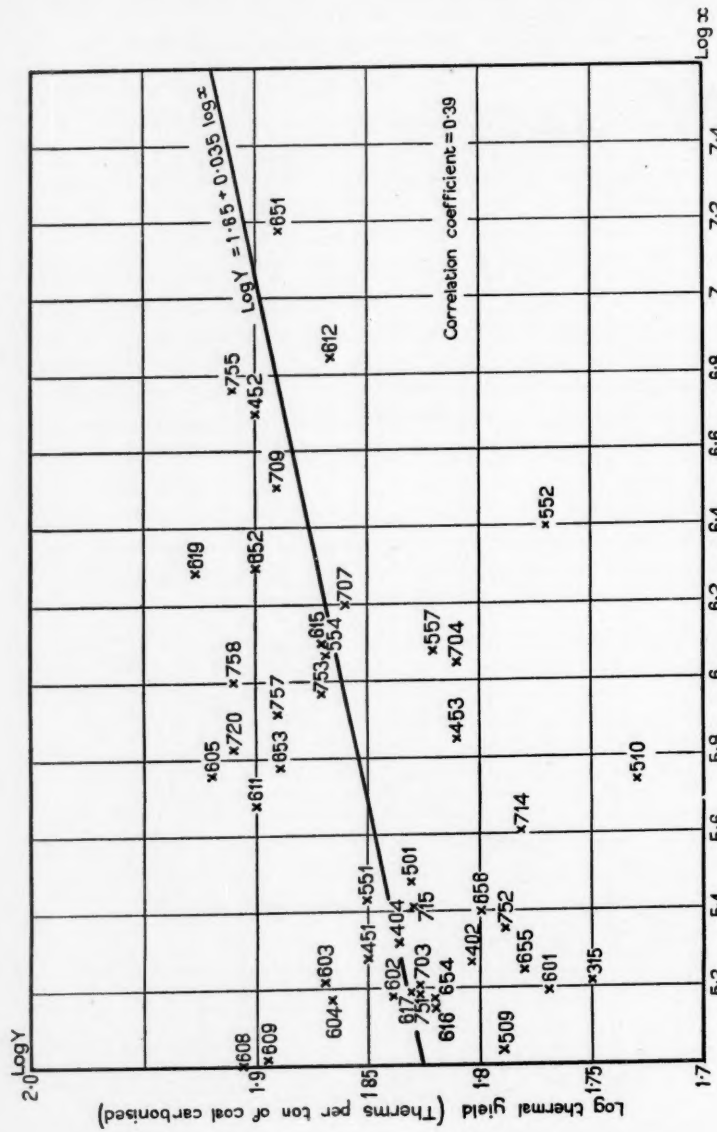

Fig. 3. Relation of thermal yield and size of undertaking.

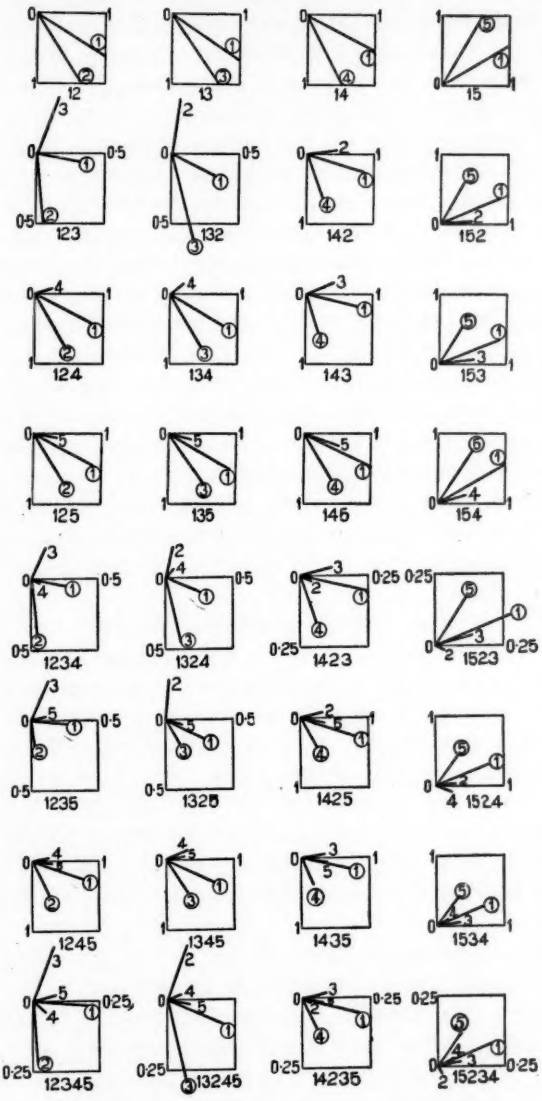

FIG. 4. Bunch-maps. Production costs of gas making.

Log size of undertaking (Therms)

FIG. 3. Relation of thermal yield and size of undertaking.

Part II

Having analysed the factors affecting the cost of production of gas in general, the next step is to try to incorporate some of the estimating equations obtained in an explanation of the variation of the cost of production of the different gas-works of the sample.

The cost of making town gas is a function of the following three broad factors: firstly, the types of gas which have to be made, or bought, to meet the demand of the area which is served by the gas-works; secondly, the technical efficiency of the gas-works; and thirdly, the prices which have to be paid for the various materials and services used in production.

The method adopted is to calculate the theoretical net cost of production for a gas-works of a given size from the estimating equation $X_1 = 1{\cdot}7 - 0{\cdot}12X_2$ (given in Fig. 1). This theoretical net cost is then compared with the actual net cost for this gas-works which is given in the accounts, and an attempt is made to 'explain' this difference between theoretical and actual net cost by a measurement of the relative importance, in terms of money, of these three factors.

The influence of the first of these factors, namely the types of gas made to meet the demand of the district, is obtained by estimating the extra cost (in pence per therm of all gas sold) which is incurred by making gas other than coal gas.

The second of these factors is technical efficiency, and this can be measured (for our purpose) in two ways: the first aspect of technical efficiency is output of gas made in therms per retort-house worker, and the second aspect is thermal yield per ton of coal carbonized. These two aspects of technical efficiency are related to the size of the undertaking. The correlation coefficient between size and output per retort-house worker is $+0{\cdot}83$ and between size and thermal yield is $+0{\cdot}39$, and so two further estimating equations can be calculated. The first of these, relating size and output per retort-house worker, is shown in Fig. 2, and the second estimating equation, which relates size and thermal yield, is given in Fig. 3.

These two estimating equations can be used to calculate the level of technical efficiency which is expected to be associated with a given size of undertaking. The difference between the 'expected' level of technical efficiency and the actual level at a certain undertaking, when evaluated in pence per therm, can be taken as a contribution towards the 'explanation' of the initial difference between actual and theoretical net cost into holder.

A simple example will make this clear. The estimating equation (and fitted line) given in Fig. 3 shows that an undertaking with sales of one

million therms in the accounting period considered can be expected to have a thermal yield of 72·5 therms (log. 72·5 = 1·86). If this particular undertaking under review has an average thermal yield of 70 therms, then the evaluation of this 2·5 therms difference in pence per therm is calculated in the following manner:

The gross cost of coal purchased at 60 shillings per ton and carbonized at a thermal yield of 70 therms per ton is 10·3 pence per therm. The gross cost of coal purchased at 60 shillings per ton and carbonized at a thermal yield of 72·5 therms per ton is 9·9 pence per therm.

Therefore the difference between actual and theoretical level of technical efficiency is 10·3—9·9 = 0·4 pence per therm.

The other aspect of technical efficiency (output per retort-house worker) can be evaluated in a similar manner by using the 'appropriate' estimating equation.

The last factor is the relative prices of goods and services used. This is best covered by comparing in a direct manner the actual price paid for coal and also the revenue received from the sale of residual products with the weighted averages for the forty-five undertakings of the sample.

This method of explaining the discrepancy between theoretical and actual costs is set out below in Appendix I and the results of the attempts to reconcile these two costs for nine large undertakings are given in Table VII.

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TABLE I

Production Costs for Forty-five Undertakings (pence per therm sold)

Class (000 therms sold)	Class letter	Gross cost of coal	Rev. from residuals	Net cost of coal	C.W.G. manufacture	Carbonization	Other	Repair and maintenance	General	Net cost into holder	No. in class
		1	2	3	4	5	6	7	8	9	10
101–200	A	13·24	6·87	6·37	0·02	2·78	0·54	2·01	0·46	12·18	16
201–500	B	12·01	7·21	4·80	0·43	2·10	1·01	1·86	0·25	10·45	8
501–1,000	C	10·5	5·96	4·54	0·64	0·89	0·56	1·92	0·17	8·72	7
1,001–3,000	D	9·85	5·48	4·37	1·14	0·94	0·84	1·79	0·39	9·47	9
3,000 and over	E	9·37	5·07	4·30	0·60	0·60	0·57	1·47	0·30	7·84	5
Weighted average	..	9·85	5·40	4·45	0·70	0·84	0·65	1·62	0·30	8·56	45

TABLE II

The Structure of Production Costs of Forty-five Undertakings (in percentages)

Class (000 therms sold)	Class letter	Gross cost of coal	Rev. from residuals	Net cost of coal	C.W.G. manufacture	Carbonization	Other	Repair and maintenance	General	Net cost into holder	No. in class
		1	2	3	4	5	6	7	8	9	10
101–200	A	108·7	56·4	52·3	0·2	22·8	4·4	16·5	3·8	100·0	16
201–500	B	114·9	69·0	45·9	4·1	20·1	9·7	17·8	2·4	100·0	8
501–1,000	C	120·5	68·4	52·1	7·3	10·2	6·4	22·0	2·0	100·0	7
1,001–3,000	D	104·0	57·8	46·2	12·0	9·9	8·9	18·9	4·1	100·0	9
3,000 and over	E	119·5	64·7	54·8	7·7	7·6	7·3	18·8	3·8	100·0	5
Weighted average	..	114·8	63·0	51·8	8·1	9·9	7·6	18·9	3·7	100·0	45

TABLE III

Operating Costs for Forty-five Undertakings (pence per therm)

Class (000 therms sold)	Class letter	Net cost into holder	Distribution	Collection	Consumer service	Admin. (local)	Welfare	Rates	Total operating cost	No. in class
		1	2	3	4	5	6	7	8	9
100–200	A	12·18	0·74	0·60	+0·86	0·80	0·27	0·58	14·31	16
201–500	B	10·45	1·01	0·64	+0·26	0·91	0·38	0·51	13·64	8
501–1,000	C	8·72	0·45	0·55	+0·54	0·73	0·27	0·49	10·67	7
1,001–3,000	D	9·47	0·61	0·66	+0·55	0·53	0·41	0·47	11·59	9
3,000 and over	E	7·84	0·61	0·67	+0·30	0·26	0·48	0·47	10·03	5
Weighted average	..	8·56	0·62	0·65	+0·40	0·40	0·40	0·48	10·75	45

TABLE IV

The Structure of Operating Costs for Forty-five Undertakings (percentages)

Class (000 therms sold)	Class letter	Net cost into holder	Distribution	Collection	Consumer service	Admin. (local)	Welfare	Rates	Total operating cost	No. in class
		1	2	3	4	5	6	7	8	9
100–200	A	85·0	5·2	4·2	+6·0	5·6	1·9	4·1	100·0	16
201–500	B	76·6	7·4	4·7	+1·9	6·7	2·8	3·7	100·0	8
501–1,000	C	81·8	4·2	5·2	+5·1	6·8	2·5	4·6	100·0	7
1,001–3,000	D	81·6	5·2	5·7	+4·8	4·6	3·5	4·1	100·0	9
3,000 and over	E	78·2	6·1	6·6	+3·0	2·6	4·8	4·7	100·0	5
Weighted average	..	79·6	5·8	6·0	+3·7	3·7	4·1	4·5	100·0	45

NOTES ON TABLES I–IV

The following notes are based on the code of accounts and describe the costs which are included in the various headings of these tables.

Gross cost of coal. All the direct costs incurred in bringing coal to the gas-works plus the cost of unloading and handling.

Revenue from residuals. Net revenue from the sale of by-products including an allowance for by-products used internally.

C.W.G. manufacture. The cost of oil and coke used in the production of carburetted water gas plus the gross wages of workers directly associated with the production of this gas.

Carbonization. The wages of those workers directly associated with production of coal gas.

Other. The cost of condensing, exhausting, metering, and purifying gas.

Repair and maintenance. Repair and maintenance of plant and buildings directly connected with gas manufacture.

General. The cost of general services at gas-works, e.g. watchmen, ambulances, firemen, &c.

Distribution. The cost of storage and transmission of gas, including the maintenance of mains and services.

Collection. The cost of rendering and collecting gas accounts, including hire purchase and fittings accounts.

Consumer service. The cost of maintaining meters and appliances plus cost of installation of appliances, less the surplus from the sales of appliances and work which is charged for and less rents received from meters and appliances. This item in Tables III and IV is shown as a surplus.

Administration (local). Salaries and wages of managers, accountants, and clerks not specifically chargeable to other headings, plus cost of administrative printing, postage, stationery, rent of offices, &c.

Welfare. The cost of national insurance contributions, pensions, superannuation, canteens, education schemes, &c.

Rates. The general rates on works, premises, offices and showrooms—not including water rates. The level of rates is a function of the level of 'profit' in a given period.

Capital charges and headquarters administration costs are not included in the tables. These costs are allocated to individual undertakings in a conventional manner.

TABLE V

Matrix of Simple Correlation Coefficients (Zero Order)

	1	2	3	4	5
1	1·00	−0·63	−0·69	−0·50	+0·56
2	..	1·00	+0·83	+0·39	−0·33
3	..	..	1·00	+0·46	−0·31
4	..	..	..	1·00	−0·12
5	..	..	..	..	1·00

1 = Log. of net cost of making gas.
2 = Log. of size.
3 = Log. of output per man.
4 = Log. of therms made per ton of coal.
5 = Log. of net cost of coal.

TABLE VI

Calculated Net Cost into Holder compared with Actual Net Cost into Holder (pence per therm)

Undertaking No.	*Annual sale of gas (000 therms)*	*Accounts net cost into holder (pence per therm sold)*	*Calculated net cost into holder (pence per therm sold)* $X_1 = 1{\cdot}45 - 0{\cdot}21X_3 + 0{\cdot}21X_5$ *(See page 198)*
1	16,800	8·4	8·8
2	7,800	10·5	10·0
3	6,500	5·6	8·0
4	5,500	6·3	5·7
5	3,500	6·0	7·7
6	2,900	10·5	9·1
7	2,100	9·9	8·6
8	2,000	7·2	7·0
9	1,700	9·8	8·0
10	1,400	6·3	7·6
11	1,300	8·9	7·8
12	1,300	9·8	9·8
13	1,300	9·7	9·7
14	1,100	11·1	9·7
15	1,000	7·3	8·0
16	900	7·4	10·0
17	800	8·9	8·9
18	700	9·5	9·0
19	700	9·3	9·2
20	600	8·5	9·1

TABLE VII

Summary of an Attempt to 'explain' the Difference between Theoretical and Actual Net Cost into Holder for Nine Large Undertakings (pence per therm sold)

Undertaking No.	*Theoretical net cost**	*Actual net cost*	*Difference to be explained*	*Amount of difference explained*	*Residual*
1	6·6	8·4	1·8	1·4	0·4
2	7·2	10·5	3·3	3·2	0·1
3	7·4	5·6	1·8	0·9	0·9
5	8·0	6·0	2·0	1·4	0·6
6	8·2	10·5	2·3	3·2	0·9
7	8·5	9·9	1·4	1·7	0·3
8	8·5	7·2	1·3	2·5	1·2
9	8·8	9·8	1·0	1·3	0·3
10	9·0	6·3	2·7	2·2	0·5

* Using the estimating equation $X_1 = 1{\cdot}7 - 0{\cdot}12X_2$ from Fig. 1.

APPENDIX I

Comparison of Theoretical with Actual Net Cost into Holder for Undertaking No. 2

Net cost into holder (from accounts)	10·5	pence per therm
Theoretical net cost into holder (Fig. 1)	7·2	„ „
Difference	3·3	„ „

1. *The effect of the excess cost of making water gas*

Average prime cost of coal gas made	6·3	pence per therm
„ „ „ water gas made	9·3	„ „
Difference	3·0	„ „

Water gas is 13 per cent of all gas made.

Therefore the excess cost of making water gas = 3·0 pence × 0·13
= 0·4 *pence per therm.*

2. *The effect of differences in technical efficiency*

(*a*) Actual output per retort-house worker	63,000 therms	(from accounts)
Theoretical output per retort-house worker	170,000 „	(Fig. 2)
No. of retort-house workers employed	124	
Theoretical number of retort-house workers required		

$$124 \times \frac{63}{170} = 46.$$

Therefore the theoretical saving in wages is (124 − 46) × £300 per year.
= 0·8 *pence per therm.*

(*b*) Thermal yield (from accounts)	73·8	therms	per ton of coal
Theoretical thermal yield (Fig. 3)	77·6	„	„ „
Difference	3·8	„	„ „

The price of coal at this undertaking is 64·8 shillings per ton and at a thermal yield of 73·8 therms the gross cost of coal is 10·5 pence per therm.

At a thermal yield of 77·6 therms the gross cost of coal is 10·0 pence per therm.

Therefore the difference is 0·6 *pence per therm.*

(*c*) 'Accepted' average percentage of gas not accounted for[1]	6·0	per cent.
Percentage not accounted for at this undertaking	6·7	„
Difference	0·7	„

This represents 10·5 pence × 0·7 per cent. = 0·1 *pence per therm.*

3. *The effect of difference in prices.*

(1) Price of coal at this undertaking	64·8	shillings	per ton
Average price of coal for the 45 undertakings of the sample	60·7	„	„
Difference	4·1	„	„

At a theoretical thermal yield of 77·6 therms per ton this difference represents 0·6 *pence per therm.*

(2) Revenue from the sale of by-products at this undertaking	4·6	pence	per therm
Average revenue from the sale of by-products for the sample	5·4	„	„
Difference	0·8	„	„

Sum of explained differences (pence per therm):

Excess cost of water gas	−0·4	pence
Output per retort-house worker	−0·8	„
Thermal yield	−0·6	„
Gas not accounted for	−0·1	„
Higher cost of coal	−0·6	„
Lower revenue from by-products	−0·8	„
	−3·3	„

Therefore the unexplained difference is 0·1 *pence per therm.*

[1] Gas not accounted for is the difference between the amount of gas registered when sent out from the works and the sum total of the readings of consumers' meters.

INDUSTRIAL STOPPAGES AND THEIR ECONOMIC SIGNIFICANCE[1]

By SHEILA V. HOPKINS

I

THE issue of these *Papers* in June 1950 contained a study of the movements of wage-rates in five countries from 1860 to 1939.[2] The object of the present paper is to study the connexions between these movements and changes in the intensity of labour unrest as indicated by the available data on industrial stoppages.

II

Throughout this note the term 'industrial stoppage' will cover both strikes and lock-outs; if there seems a prima facie case for distinguishing between the two, there are reasons, both analytical and statistical, why it is better not to do so. Analytically, the intended distinction depends on which party takes the initiative to change the terms of employment; strikes are stoppages of work declared and organized by workers to enforce a demand, lock-outs are stoppages declared and organized by employers. But the distinction, though it sounds simple, proves on examination to be of little use: a strike may be provoked by employers, and a lock-out may be caused by the attitude of the workers. For example, men may decide they will no longer work on Saturdays, and do not present themselves at the factory on that day; they arrive as usual on Monday morning only to find the employer refusing them entrance. Although this appears as a lock-out, it is the workers who are demanding a change in their terms of employment. Further, it is often impossible to say which party is demanding new terms, for existing conditions may have ceased to apply. Disputes arise from changes in working methods: an employer may introduce a new process entailing the use of three men per machine where formerly four were used; the men refuse to work the new method, the employer refuses to withdraw it. The dispute is at the same time both strike and lock-out, for neither party is willing to continue work on terms acceptable to the other. Many disputes are about the interpretation, or application to unforeseen circumstances, of an existing agreement—one cannot say that either side is refusing to work on existing terms and demanding new ones; the question in dispute is what the existing terms are. A similar difficulty arises when the situation is such that the men do not present

[1] The writer wishes to acknowledge a debt of gratitude to Professor E. H. Phelps Brown for his help and advice during the preparation of this article.

[2] 'The Course of Wage-rates in Five Countries, 1860–1939', by E. H. Phelps Brown and Sheila V. Hopkins. The countries covered are France, Germany, Sweden, U.K., and U.S.A.

themselves for work on a particular day, though, had they done so, they would have been refused admittance. Indeed, the character of a dispute may change during its course: from a strike may emerge a lock-out, a lock-out may develop into a strike. It may be hard to say, when a stoppage occurs at the end of negotiations, whether the men are refusing to continue work on terms offered by the employer or vice versa. Thus the question whether a stoppage is strike or lock-out is often only a matter of the formal declaration of the dispute, and of no particular significance.

There are also statistical considerations. The ratio of reported lock-outs to reported strikes is very low. To the beginning of the First World War, in four out of the five countries considered here, the following proportions hold:

France	1:167
Germany	1: 8·3
Sweden	1: 11
U.S.A. (to 1905)	1: 23·8.

In the inter-war period, with the exception of France, the ratios are even lower. With minor exceptions, moreover, there is no systematic difference in the behaviour of strikes and lock-outs; in years with many strikes, lock-outs are numerous; when the number of strikes decreases, lock-outs are few. There are a few instances of lock-outs increasing and strikes decreasing in number in years of depression (Germany, 1912–13 and 1924, U.S.A. 1894 and 1921), and the reverse occurring in times of prosperity (Germany, 1911; U.S.A. 1902), while in Sweden, although there is marked similarity in the trend of the two series, there is not the same close similarity in year-to-year movement that is found elsewhere. An examination of figures showing the number of workers involved and the number of man-days lost in both strikes and lock-outs does not alter the conclusion reached above, that the movements in the two series are closely related. It is not, therefore, surprising that in many countries official statistics have ceased to distinguish between these two types of industrial stoppage. In 1889, when the first official reports on strikes and lock-outs were published in Great Britain, the distinction was attempted, only to be abandoned permanently in 1893; in the U.S.A. the twofold classification was maintained from 1881 to 1905 and from 1914 to 1921,[1] but since 1922 the term 'work stoppages' has been used to cover both strikes and lock-outs. The Swedes, finding that they could not accurately say, in many cases, that a stoppage was either strike or lock-out, adopted a third classification, *arbetsinställelser av blandad karakter*, while in France the numbers of reported lock-outs are so small and erratic in occurrence that they suggest difficulty in allocating a dispute to the appropriate category.

[1] No official U.S. statistics on industrial stoppages were published between 1905 and 1914.

III

Industrial unrest can be measured in several ways. The simplest and most obvious is to count the number of stoppages taking place each year; but it is desirable, also, to know something of the average size of stoppages, as measured by the number of men involved, and of their average duration. Each concept, considered alone, gives only a partial picture of the climate of industrial relations.

In this study the 'average size' of a stoppage depends on the number of wage-earners directly[1] or indirectly[2] involved (the latter includes those not striking, who are forced to cease work because a stoppage is in progress). The figure for each year is obtained by dividing the total number of workers involved in stoppages in that year by the number of stoppages occurring. Obviously such a crude average is but an imperfect measure of size; the occurrence of one or two large disputes in a period of relatively small outbreaks could completely distort the picture. Calculation of the mode, giving the most frequently occurring size of stoppage, would be more instructive, but the necessary detailed information, showing numbers of men involved in every stoppage in each year, is not usually available. On the other hand, diagrammatic representation of the average size of stoppages shows that, once an upward or downward trend begins, it continues for some years; thus it appears that, despite possible irregularities of annual movements, this average reflects an orderly process of change.

The term 'duration' is not used here in its most widely accepted sense: it does not show how long the average stoppage lasts, but the number of days the average disputant is away from work. Thus, it is an average of the length of time that stoppages last, *weighted* by the number of men involved. It is calculated by dividing the total of man-days lost in all stoppages in a given year by the number of men concerned in them. (It was not until 1927 that information on man-days lost first became available in the U.S.A.)

For purposes of exposition, the years 1880 to 1950 with which this study is concerned have been divided into three periods: the first covers the years to 1914, the second extends from 1914 to 1939, and the third from 1939 to 1950.

The following general features characterize the three stoppage series:

1. All three series in each country, and in each period, show considerable fluctuation.

[1] France, Sweden, United Kingdom.

[2] Germany, U.S.A. The fact that the data are not strictly comparable in this way is of little present importance as, in all cases where comparison is possible, the two series are found to move closely together.

2. For the most part there is no obvious relationship between year-to-year movements of number, size, and duration; nor in the long-term trends of the three series.
3. In number, size, and duration we find patterns or trends; these patterns change from period to period; often, though not always, they differ from one country to another in any one period. For example, in each of the three periods the number series shows a different pattern, but within any one period the pattern is for the most part common to all countries (with the exception of U.K. down to 1914). The size series move quite independently throughout; patterns of duration are not strongly marked in period I, and show both divergence and agreement of movement within the later periods.

(The foregoing characteristics and patterns are shown very clearly in the diagrams on pp. 218–20.)

IV

Industrial stoppages are the outcome of discontent; if workers or employers are dissatisfied with some aspect of the employment contract, and the other side refuses to concede a change, disagreement degenerates into open conflict. Official statistics record that in most countries well over one-half of the stoppages occurring in any period have been attributed to disputes over wages. Further investigation shows that, although disputes over wages in general do not seem closely related to business activity, disputes arising specifically from demands for wage-*rises* are subject to considerable cyclical influence. It could be and has been argued that, as prices rise faster than wages during a boom, the prominence of disputes centring around demands for wage increases at such times arises from discontent over falling real wages; and that, conversely, during a recession the incentive to strike is diminished by rising real wages. The effect on the readiness to strike of variations in real and money wages, and of cyclical economic changes, can be roughly estimated by comparing these variables with the intensity of industrial disputes.

The fluctuations so strongly imposed on the trends of number, size, and duration of stoppages suggest that the trade cycle has a considerable short-term influence on the course of events. In practice, however, the level of economic activity appears to be far more closely connected with the *frequency* of stoppages than with their size or duration. While it is not true to say that an index of the trade cycle and one of the frequency of stoppages stand in any definite mathematical relationship with each other, it is indisputable that they move up and down together: in times of prosperity, when employment is high, disputes increase: during a depression there is comparative industrial peace. Although Germany in

the nineteen-twenties and Sweden in the nineteen-thirties prove exceptions, this relationship is well marked throughout periods I and II, and only in the last ten years, when employment has tended to remain at a relatively high level, have the two series diverged.

The average *size* of stoppages in any particular year or over a range of years seems quite unrelated to the level of activity. If, for a short period, the two move together in any one country, they soon diverge, and there is no systematic 'sameness' of movement in several countries at the same time. One is led to believe, indeed, that any correlation of movement between the two series is purely fortuitous. However, in drawing this conclusion it is well to bear in mind that the measure of average size is itself imperfect, and that the 'average size of a stoppage' as here calculated may bear no constant relationship to the 'size of the average stoppage'.

There is some tendency for the *duration* of stoppages to vary inversely with industrial activity, for either employer and/or employed to be more stubborn in a depression and more conciliatory when industry is prospering. This inverse relationship of employment and duration is less clearly marked than the relation between employment and frequency, and its degree of constancy varies considerably between countries; but it seems less likely to be fortuitous than was any connexion with size.

We see, then, that the number of stoppages and probably their duration vary with the phases of the trade cycle, but that their average size, apparently, does not.

If money and real wage-rates too are strongly influenced by the cycle, then perhaps some causal link can be forged. But one of the most remarkable facts that emerged from the earlier study[1] was the complete absence of strong cyclical fluctuations in money and real wages. From 1880 to 1913 there were hardly half a dozen years when money wages[2] did not rise in all five countries, though such falls as there were certainly occurred in years of cyclical depression. The inter-war years were everywhere more disturbed, and the cyclical patterns more marked, but there was still a tendency for average money wages to rise more than they fell. The years from 1939 to 1950, like those of period I, have been years of almost uninterrupted rises in money wages.

[1] Phelps Brown and Hopkins, op. cit.

[2] Throughout this study any reference to the level of wages must be understood to apply to wage-*rates* as opposed to earnings. It is extremely difficult, often impossible for many years, to obtain sufficiently accurate and detailed information to calculate a general index of earnings. The data concerning wage-rates are more reliable, and more likely to be comparable between countries; there seems little doubt, moreover, that in the long run, at least down to 1939, the wage-rate does reflect the trend in earnings, although it tends to hide the true extent of increases gained during periods of brisk activity when overtime is common, and of decreases suffered during a depression when short-time is worked.

This great and general rise in money wages has been no isolated phenomenon: with it has gone a rise in real wages hardly less arresting. It is true that, down to 1914, real wages fluctuate more than money wages, and that some of those fluctuations are cyclical; but, in the inter-war years, and over the last 10 years, they have been rising steadily from year to year, with very few exceptions. It seems only too clear that the trade cycle, though affecting money and real wage movements to some extent, has a much more pronounced influence on the occurrence of industrial unrest.

It has been found that in the short period there seems to be some connexion between active industrial unrest and the trade cycle, but not between such unrest and changes in money or real wages. These short-term fluctuations are but one side of the picture. They may provide an answer to the question, Why do more stoppages occur in some years than in others? They do not explain a confirmed tendency for the number of stoppages to rise or fall over a much longer period: a trend superimposed upon short-period year-to-year movements.

The very pronounced patterns of movement in the stoppage series surely indicate the existence of an orderly process of change. Can it have been influenced in any way by the secular changes in money and real wages? Have relations between employers and employed steadily deteriorated when money and real wages have ceased to rise for several years, or when wages have been rising less or falling more than the average of money incomes generally? The conjecture seems likely; yet the data of this study reveal no consistent connexion. Both money and real wages, and the number of stoppages, were rising for the major part of period I, but whereas the money wage rise was sustained, the rise in the number of stoppages was not; nor did the latter move any more consistently with real wages, for, though these fell off in France, Germany, and the U.K. within this period, the years of inflexion were not those of the stoppage series.[1]

This apparent lack of connexion between stoppages and money and real wages is found also in the inter-war years and in the period after 1939. It is found, too, if changes in the stoppage series are compared, not with year-to-year changes in wage movements, but with 'cumulative' wage changes which show for any particular year the change (positive or negative) over the level of, say, 3 years previously—thus indicating the rate of rise or fall in the general level of wages at any particular time compared with the level of the immediately preceding period.

Changes in money wage rates, compared with changes in the average of

[1] In France and the U.K. the course of duration moves closely with that of real wages, providing an exception to the general picture.

money incomes generally, are shown by the wage-income ratio, a concept with which readers of an earlier article are familiar. It is, briefly, the index of money wage rates divided by an index of national income per head of the active population. The wage-income ratio falls when money wage rates rise less or fall more than the average of money incomes generally, and vice versa. From 1890 to 1914 the wage-income ratio fell, and for almost three-quarters of the time the number of stoppages increased; but, in the inter-war period, and since 1939, the two series moved together rather than in opposition.

V

The most notable point to emerge from the foregoing is the apparent lack of connexion between the level and the movements of a worker's money and real wages, and the likelihood of a stoppage; this has persisted over both the short and the long period, and it is by no means confined to any one particular country or period. It has already been noted, however, that well over half of the stoppages occurring in any particular period have been attributed to disputes over wages. The relative importance of these wage disputes, as the ostensible cause of stoppages, appears subject to two forces: one which shapes events from year to year, the other over a period of years. In the shorter period the influence of the trade cycle is clearly indicated: a very close correlation is found between years having a high employment (and presumably profit) rate, and in which generally prices were rising, and those showing a large proportion of stoppages caused by demands for wage rises; conversely, disputes which aim to prevent wage reductions are most numerous when employment is relatively low. It is not within the scope of this paper to comment at length upon the longer-run forces, but we can note certain facts: in the United Kingdom since 1911 the importance attributed to the wage-issue as a causal factor has been steadily declining; there was a similar tendency in Sweden from 1916 to 1930, in France from 1909 to 1935, and in the United States from 1920 to 1939. In Sweden and the United States in later years wages are accorded somewhat greater importance again.

Can the negative findings of Section IV of this study be reconciled with the positive assertions of the official statistics? Is it, perhaps, that wage disputes, while made the *occasions* to strike, are not the underlying causes? Such a view would be compatible with the conclusions of Professor J. T. Dunlop in his article, 'The Movements of Real and Money Wage Rates', *Economic Journal*, September 1938. Certainly the great changes in real earnings over the last 60 years have brought no corresponding change in the course of industrial unrest, and money wages, relentlessly pursuing their upward course, can, it seems, lay no claim to the term 'causal factor'.

In the connexion between the number of stoppages and the trade cycle does the link lie not in changes in money or real wage rates but in the ability of the workers to fight a claim successfully—or at least in their expectations about that ability? In a period of brisk economic activity, near the top of a boom, the workers feel in a strong position: the employer is making large profits and he does not want to forgo them by a stoppage of work; the demand for labour at a particular moment may exceed the supply; the manufacturer finds orders piling up and wishes to execute them in the shortest possible time; even if a man is sacked for engaging in strike activity, he can easily find work elsewhere; there is a general feeling that employers are making large profits and that the workers are entitled to a share of them. André Philip, in a contribution to *Organised Labour in Four Continents*,[1] shows how a similar sort of psychology worked in France in the early days of the trade-union movement. Wages were relatively low among the industrial workers and the rates of their contributions to their unions or syndicates were correspondingly small. As no reserve funds capable of supporting a sustained work stoppage could be built up, the only hope of gaining any concession from employers was to strike when they had large orders on hand and would be hurt by a cessation of work. In a period of high unemployment, however, the worker is very loath to do anything which may lose him his job; he realizes that his employer often has very little incentive to keep him employed in any case and does not want to provoke dismissal when it is not easy to find alternative work.

The foregoing points—concerned mainly with the worker's *ability* to strike—were of greatest consequence in the early stages of trade-unionism; though still of importance, they carry less weight for workers organized in strong unions with considerable funds. Yet, whatever the ability to strike, the likelihood of a successful outcome to a stoppage varies with the cycle; wage claims in particular are more likely to succeed when an increase in labour costs can be met from profits, without resulting in a curtailing of operations.

While the number of disputes is positively correlated with industrial activity, their duration, on the whole, seems to stand in a negative relationship with the cycle. Such stoppages as do occur in times of depression are long drawn out, those occurring in a boom, although numerous, are comparatively short. When business is bad it is often of no very great concern to an employer if he has to close down the whole, or part, of his plant for a week or so. If turnover is much reduced and he is merely keeping on his men from humanitarian motives, or because he wants to keep together the nucleus of a trained labour force, the employer may be

[1] Edited by H. A. Marquand.

in no great hurry to terminate a stoppage of work, which is looked upon as one way of cutting costs by saving on wages. The men, who may be resisting a wage-cut or the dismissal of staff, feel that they must hold out to prevent such measures being put into effect; the fact that they are on strike at all at such a time seems an indication that they consider the dispute sufficiently serious to be carried through to the bitter end. When business is brisk, however, the employer has every reason to desire a speedy settlement of any dispute—he is more likely to make concessions to the strikers when he feels their continued absence from work is depriving him of profitable trade.

This tendency of the trade cycle to influence the temperature of industrial relations has been commented on before; the findings of the present study in this respect have served merely to extend the analysis to other countries and for a longer period of time.

But, while it may be possible to account for events in the short run in such a way, it appears far less easy to explain the longer term course of development. The very remarkable and so clearly defined patterns of the three stoppage series cannot be purely fortuitous—*a course of change is systematically working itself out over a number of years in several countries.* It must be shaped by strong forces, but they do not appear to be those economic forces usually associated with labour unrest. What they are can, at present, be only a matter of conjecture; this note has raised many questions but provided few answers. It seems only possible to say here that changes of a definite kind will no doubt continue to take place regardless of movements in money and real wages.

LONDON.

We have learned with deep regret, as we go to press, of the death of Professor W. H. Macgregor, who held the Drummond Chair of Political Economy in the University of Oxford from 1922 to 1945.

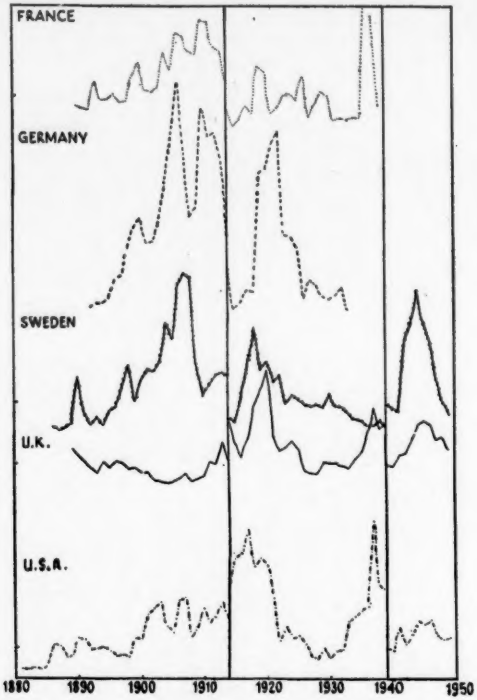

FIG. 1. Indices of the number of disputes.

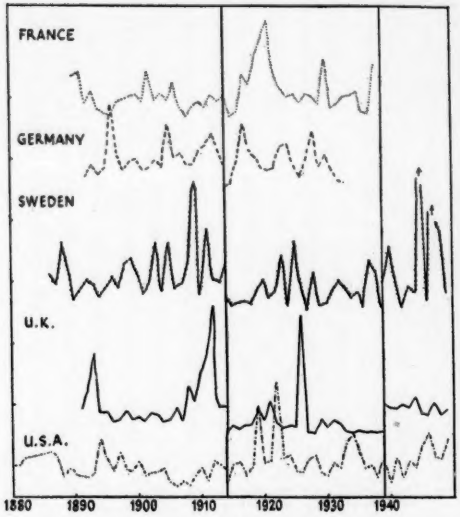

FIG. 2. Indices of the size of disputes.

Note. Period I, 1890–9 = 100; Period II, 1925–9 = 100; Period III, 1939 = 100 in all diagrams.

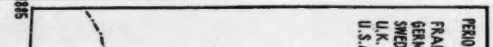

FIG. 4.

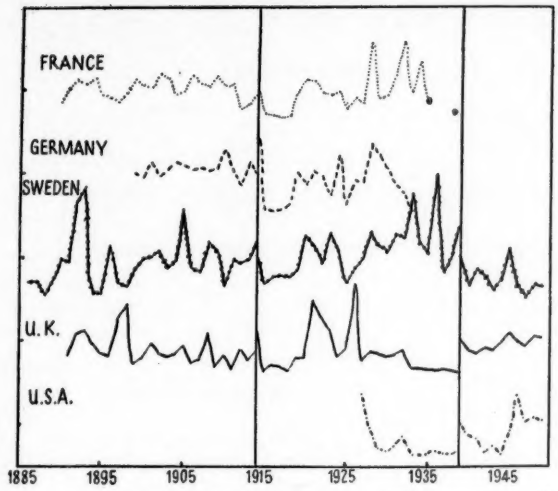

FIG. 3. Indices of the duration of disputes.

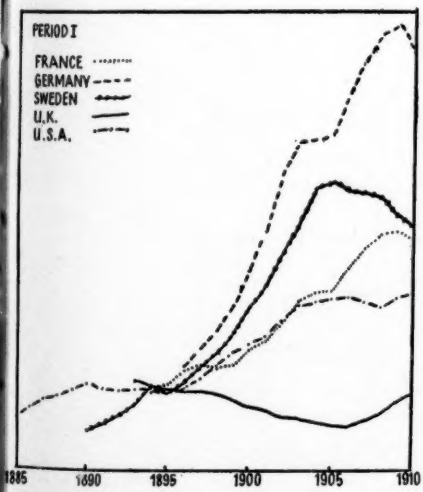

FIG. 4. Nine-year moving averages of the number of disputes.

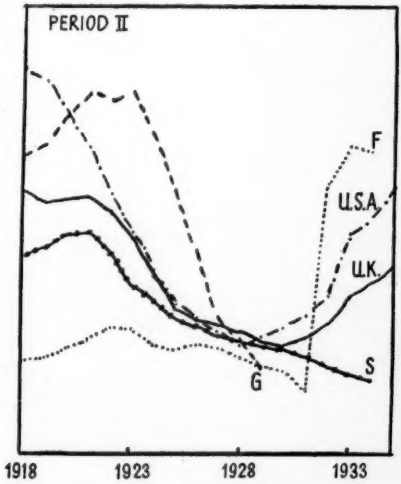

FIG. 5. Nine-year moving averages of the number of disputes.

Note. Period I, 1890–9 = 100; Period II, 1925–9 = 100; Period III, 1939 = 100 in all diagrams.

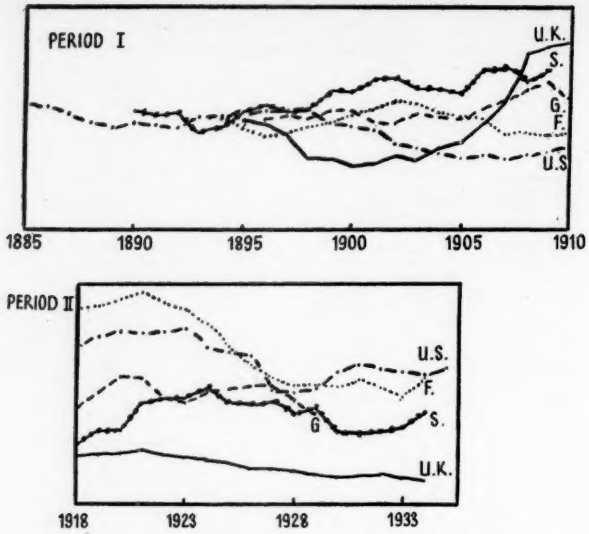

FIG. 6. Nine-year moving averages of the size of disputes.

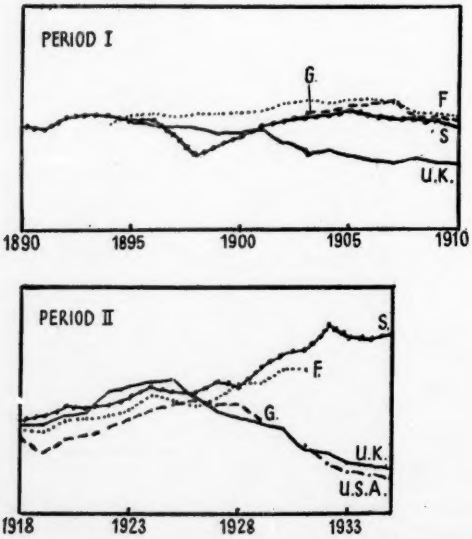

FIG. 7. Nine-year moving averages of the duration of disputes.

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PRINTED IN GREAT BRITAIN
AT THE UNIVERSITY PRESS, OXFORD
BY CHARLES BATEY, PRINTER TO THE UNIVERSITY